TL
242
.E6555
1988

90 3148

DEPARTMENT OF TRANSPORTATION
DEC 12 1989
LIBRARY

U.S. Department of Transportation
National Highway Traffic Safety Administration

DOT HS 807 351
Final Report

October 1988

Final Report of Frontal Barrier Impacts of a 1985 Pontiac Grand AM 2-Door Coupe in Support of Crash III Damage Algorithm Reformation

This document is available to the public from the National Technical Information Service, Springfield, Virginia 22161.

The United States Government does not endorse products or manufacturers. Trade or manufacturers' names appear only because they are considered essential to the object of this report.

TL
242
.E6555
1988

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
881017 DOT HS 807 351		

4. Title and Subtitle	5. Report Date
FINAL REPORT OF FRONTAL BARRIER IMPACTS OF A 1985 PONTIAC GRAND AM 2-DOOR COUPE IN SUPPORT OF CRASH III DAMAGE ALGORITHM REFORMATION	OCTOBER, 1988
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
N.A. El-Habash, Project Engineer, TRC	881017
9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
Vehicle Research and Test Center U.S. Rt. 33, Logan County East Liberty, Ohio 43319	11. Contract or Grant No. DTNH22-85-C-08123
	13. Type of Report and Period Covered
12. Sponsoring Agency Name and Address	FINAL REPORT OCTOBER-NOVEMBER 1988
U.S. Department of Transportation National Highway Traffic Safety Administration 400 Seventh St., S.W., Washington, D.C. 20590	14. Sponsoring Agency Code DOT/NHTSA/VRTC

15. Supplementary Notes

16. Abstract

Five 0° flat frontal barrier impact tests were conducted for research and development in support of the crash III damage algorithm reformulation. These tests were conducted on a 1985 Pontiac Grand AM 2-door coupe, VIN 1G2NE27UXFC748567, at the Transportation Research Center of Ohio. The following five tests were conducted on one vehicle:

TEST NO.	DATE	TIME	SPEED (mph)	AVERAGE CUMULATIVE CRUSH
881017-1	10/17/88	1020	10.0	3.9
881017-2	10/17/88	1100	20.0	12.0
881017-3	10/17/88	1130	20.0	21.6
881017-4	10/17/88	1320	18.8	24.1
881017-5	10/17/88	1435	30.6	36.8

17. Key Words	18. Distribution Statement
Flat Frontal Impact Crash III Damage Algorithm Reformation.	This document is available to the public through The National Technical Information Service, Springfield, VA 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	136	

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

TABLE OF CONTENTS

SECTION	TITLE	PAGE
1.0	PURPOSE AND TEST SUMMMARY	1-1
2.0	VEHICLE AND TEST DATA	2-1
3.0	TEST #881017-1 SUMMARY	3-1
4.0	TEST #881017-2 SUMMARY	4-1
5.0	TEST #881017-3 SUMMARY	5-1
6.0	TEST #881017-4 SUMMARY	6-1
7.0	TEST #881017-5 SUMMARY	7-1
APPENDIX A	PHOTOGRAPHS	A-1
APPENDIX B	DATA PLOTS	B-1

SECTION 1.0
PURPOSE AND TEST SUMMARY

The purpose of the five 0° frontal barrier impact tests was for research and development in support of the CRASH III damage algorithm reformulation.

The 1985 Pontiac Grand AM was equipped with a 2.5 liter, 4-cylinder, transverse, gas engine with a 3-speed automatic transmission. The intended total test weight of the vehicle was 2990 pounds. The actual weight was 2998 pounds, including 210 pounds of steel plate ballast secured in the trunk area.

The crash event was recorded by two (2) high-speed cameras.

SECTION 2.0
VEHICLE INFORMATION

TEST VEHICLE INFORMATION

VEHICLE MANUFACTURER: General Motor Corporation VIN: 1G2NE27UXFC748567

MAKE/MODEL: Pontiac Grand AM MODEL YEAR: 1985

BODY STYLE: 2-door coupe COLOR: white

ENGINE DATA: TYPE: transverse CYLINDERS: 4 DISPLACEMENT: 2.5 liter

X GAS, ___DIESEL, ___TURBOCHARGE

TRANSMISSION DATA: 3 SPEED, ___MANUAL, X AUTOMATIC, X FWD, ___RWD, ___4WD

DATE VEHICLE RECEIVED: 10/7/88 ODOMETER READING: 7855.0

DEALER'S NAME AND ADDRESS: NA

ACCESSORIES:

POWER STEERING	Yes	AUTOMATIC TRANSMISSION	Yes
POWER BRAKES	Yes	AUTOMATIC SPEED CONTROL	No
POWER SEATS	No	TILTING STEERING WHEEL	Yes
POWER WINDOWS	No	TELESCOPING STEERING WHEEL	No
TINTED GLASS	Yes	AIR CONDITIONING	Yes
RADIO	No	ANTI-SKID BRAKE	No
CLOCK	No	REAR WINDOW DEFROSTER	Yes

OTHER None

DATA FROM CERTIFICATION LABEL ON LEFT DOOR FACE OR "B" POST:

VEHICLE MANUFACTURED BY: General Motor Corporation

DATE OF MANUFACTURE: 3/85

GVWR: 3052 LBS.

GAWR: FRONT 1964 LBS.; REAR 1563 LBS.

The front of the vehicle was supported by a dolly.

TEST VEHICLE INFORMATION, CONT'D

WHEELBASE: 103.5

MAXIMUM WIDTH: 67.5

WEIGHT OF TEST VEHICLE WITH REQUIRED OCCUPANTS AND LUGGAGE:

RIGHT FRONT	1200 LBS.	RIGHT REAR	305 LBS.
LEFT FRONT	1190 LBS.	LEFT REAR	303 LBS.
TOTAL FRONT WEIGHT	2390 LBS.	(79.7% OF TOTAL VEHICLE WEIGHT)	
TOTAL REAR WEIGHT	608 LBS.	(20.3% OF TOTAL VEHICLE WEIGHT)	
TOTAL TEST WEIGHT	2998 LBS.		

WEIGHT OF BALLAST SECURED IN VEHICLE TRUNK AREA: 210 LBS.

VEHICLE TIRE DATA:

TIRES ON VEHICLE (MFR. & LINE, SIZE): Firestone Supreme P185/80R13

RECOMMENDED COLD TIRE PRESSURE: FRONT: 35 psi; REAR: 35 psi

SIDEWALL PLY RATING: 1 ply

BIAS PLY, BELTED OR RADIAL? Radial

IS SPARE TIRE "SPACE SAVER"? Yes

IS SPARE TIRE STANDARD EQUIPMENT? Yes

VEHICLE ATTITUDES:

DELIVERED:	LF:	27.2;	RF:	27.5;	LR:	30.2;	RR: 30.5
PRE-TEST:	LF:	27.4;	RF:	27.6;	LR:	29.1;	RR: 29.4
POST-TEST:	LF:	27.1;	RF:	27.6;	LR:	28.5;	RR: 29.8

ALL DISTANCE MEASUREMENTS ARE IN INCHES.

TEST ANOMALIES

Noise in the form of spikes was observed in the plots for the contact switches OTH1, OTH2, OTH3, OTH4, OTH5. * The switches were used to record the time of vehicle contact with the wall, as well as the time of vehicle separation from the barrier wall. The switches were damaged by the crush of the vehicle's bumper against the rigid barrier. The switches were replaced following each test which contained spikes. This is not the standard use of such switches.

*CONTACT SWITCH MNEMONICS:

OTH1 Vehicle contact switch - Left
OTH2 Vehicle contact switch - Center
OTH3 Vehicle contact switch - Right
OTH4 Barrier contact switch - Left
OTH5 Barrier contact switch - Right

SECTION 3.0

TEST #881017-1 SUMMARY

TEST CONDITIONS:

TEST NUMBER: 881017-1

DATE OF TEST: 10/17/88

TIME OF TEST: 1020

AMBIENT TEMPERATURE AT IMPACT AREA: 72° F

SUBJECT VEHICLE DATA:

	ACTUAL	INTENDED
TEST WEIGHT (lbs.)	2998	2990
VEHICLE ORIENTATION (deg.)	0	0
VEHICLE VELOCITY (mph.)	10.0	10.0
MAXIMUM CRUSH (in.)	6.1	
AVERAGE CRUSH = $\{\frac{C1+C6}{2}+C2+C3+C4+C5\}/5$ (in.)	3.9	

TEST NUMBER 881017-1

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

No.	LOCATION	X*	Y*	Z*	POSITIVE DIRECTION MAX G	POSITIVE DIRECTION MSEC	NEGATIVE DIRECTION MAX G	NEGATIVE DIRECTION MSEC
	VEHICLE FRONT FRAME RAIL FRONT LONGITUDINAL	161.4	18.0	28.1	1.1	133.6	13.9	40.0
2	VEHICLE HOOD LATCH CROSSMEMBER LONGITUDINAL	168.9	2.5	28.2	10.2	60.5	63.6	36.5
3	VEHICLE LEFT FENDER WELL INSIDE LONGITUDINAL	156.5	27.6	26.0	1.4	166.5	10.5	75.9
4	VEHICLE SUSPENSION LONGITUDINAL	141.5	-19.3	34.5	2.3	211.0	10.9	76.8
5	VEHICLE REAR DECK PRIMARY LONGITUDINAL	52.0	0.0	17.4	0.5	264.6	9.0	76.1
6	VEHICLE REAR DECK REDUNDANT LONGITUDINAL	52.0	1.2	17.4	0.4	3.8	9.3	72.5

* ALL MEASUREMENTS OF ACCELEROMETER LOCATIONS ARE IN INCHES.

REFERENCE: X: + FORWARD FROM REAR BUMPER
Y: + LEFTWARD FROM VEHICLE CENTERLINE
Z: + UPWARD FROM GROUND LEVEL

TEST #881017-1

AIRBAG SENSOR LOCATIONS AND DATA SUMMARY

NO.	LOCATION	X	Y	Z	SWITCH CLOSURE TIME, (MSEC)
3	VEHICLE LEFT FENDER WELL INSIDE SENSOR #1	158.0	26.5	24.5	No indication of closure
3	VEHICLE LEFT FENDER WELL INSIDE SENSOR #2	154.0	25.8	24.2	No indication of closure

REFERENCE: X: + FORWARD FROM REAR BUMPER
Y: + LEFTWARD FROM VEHICLE CENTERLINE
Z: + UPWARD FROM GROUND LEVEL

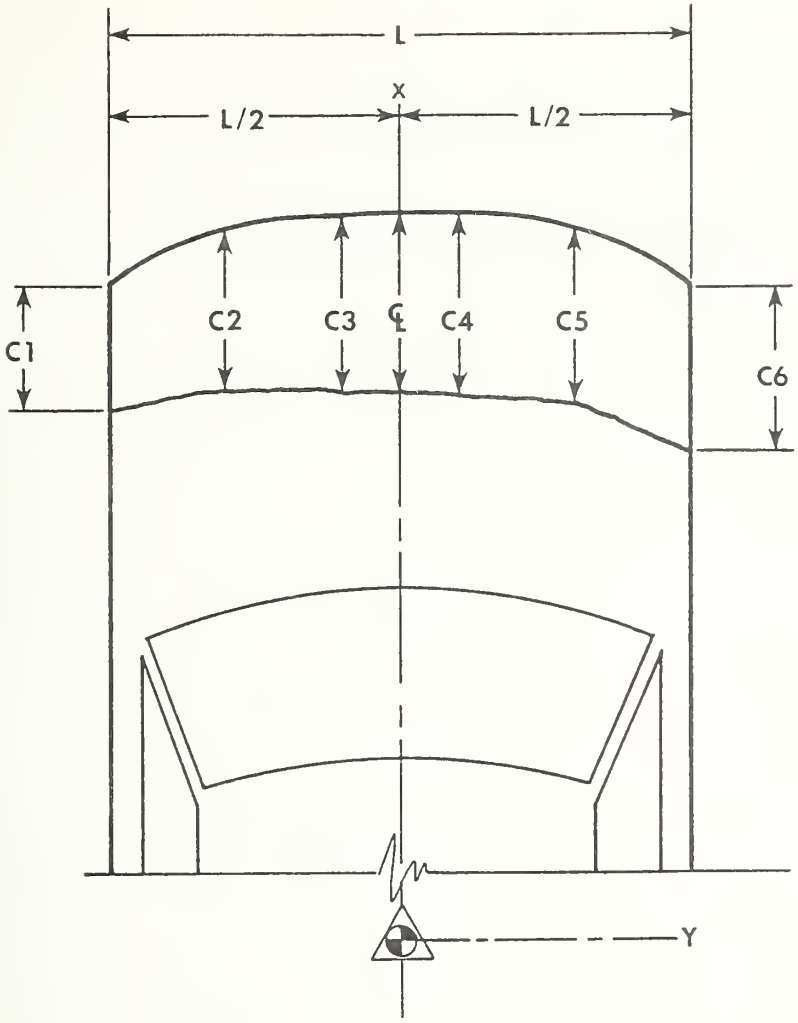
SENSOR #1 TECHNAR, MODEL S6009D001, S/N 27701-3

SENSOR #2 BREED, Model #F134, S/N 7950

CONTACT SWITCH LOCATIONS AND DATA SUMMARY

LOCATION	SEPARATION TIME (MSEC)
VEHICLE CONTACT SWITCH - LEFT	126.2γ
VEHICLE CONTACT SWITCH - CENTER	118.2
VEHICLE CONTACT SWITCH - RIGHT	144.0
BARRIER CONTACT SWITCH - LEFT	140.0
BARRIER CONTACT SWITCH - RIGHT	141.5

γ See TEST ANOMALIES



NOTE: L is pre-test length of contact surface.
C1 through C6 are spaced equally apart.
CL is taken at centerline of vehicle.
All measurements are in inches.

Vehicle 1985 Pontiac Grand AM Test #881017-1

	PRE-TEST		POST-TEST		CRUSH
L	58.0				
C1	172.0	C1	170.5	C1	1.5
C2	174.9	C2	171.1	C2	3.9
C3	176.4	C3	170.7	C3	5.7
C4	176.2	C4	170.5	C4	5.7
C5	174.2	C5	171.1	C5	3.1
C6	171.3	C6	170.5	C6	0.8
CL	176.9	CL	170.8	CL	6.1

TEST #881017-1

CAMERA INFORMATION

CAMERA NO.	LOCATION	TYPE	LENS (mm)	SPEED (fps)	PURPOSE OF CAMERA DATA
1	Right side wide	Photosonic 1B	25	500	Impact overall
2	Right side tight	Photosonic 1B	50	501	Impact closeup

SECTION 4.0

TEST #881017-2 SUMMARY

TEST CONDITIONS:

TEST NUMBER: 881017-2

DATE OF TEST: 10/7/88

TIME OF TEST: 1100

AMBIENT TEMPERATURE AT IMPACT AREA: 72° F

SUBJECT VEHICLE DATA:

	ACTUAL	INTENDED
TEST WEIGHT (lbs.)	2998	2990
VEHICLE ORIENTATION (deg.)	0	0
VEHICLE VELOCITY (mph.)	20.0	20.0
MAXIMUM CUMULATIVE CRUSH (in.)	16.1	
AVERAGE CUMULATIVE CRUSH $\{\frac{C1+C6}{2}+C2+C3+C4+C5\}/5$ (in.)	12.0	

VEHICLE ATTITUDES:

POST-TEST: LF: 28.9; RF: 31.1; LR: 28.0; RR: 28.0

TEST NUMBER 881017-2

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

o. LOCATION	X*	Y*	Z*	POSITIVE DIRECTION MAX G	POSITIVE DIRECTION MSEC	NEGATIVE DIRECTION MAX G	NEGATIVE DIRECTION MSEC
VEHICLE FRONT FRAME RAIL FRONT LONGITUDINAL	161.4	18.0	28.1	7.3	13.8	77.9	29.1
VEHICLE HOOD LATCH CROSSMEMBER LONGITUDINAL	169.9	2.5	28.2	39.4	16.6	197.6	5.5
VEHICLE LEFT FENDER WELL INSIDE LONGITUDINAL	156.5	27.6	26.0	2.7	116.9	50.3	29.3
VEHICLE SUSPENSION LONGITUDINAL	141.5	-19.3	34.5	9.0	20.5	42.4	33.5
VEHICLE REAR DECK PRIMARY LONGITUDINAL	52.0	0.0	17.4	2.7	87.4	20.3	12.6
VEHICLE REAR DECK REDUNDANT LONGITUDINAL	52.0	1.2	17.4	2.9	87.1	20.7	12.5

ALL MEASUREMENTS OF ACCELEROMETER LOCATIONS ARE IN INCHES.

EFERENCE: X: + FORWARD FROM REAR BUMPER
Y: + LEFTWARD FROM VEHICLE CENTERLINE
Z: + UPWARD FROM GROUND LEVEL

TEST #881017-2

AIRBAG SENSOR LOCATIONS AND DATA SUMMARY

NO.	LOCATION	X	Y	Z	SWITCH CLOSURE TIME, (MSEC)
3	VEHICLE LEFT FENDER WELL INSIDE SENSOR #1	158.0	26.5	24.5	16.2
3	VEHICLE LEFT FENDER WELL INSIDE SENSOR #2	154.0	25.8	24.2	32.6

REFERENCE: X: + FORWARD FROM REAR BUMPER
Y: + LEFTWARD FROM VEHICLE CENTERLINE
Z: + UPWARD FROM GROUND LEVEL

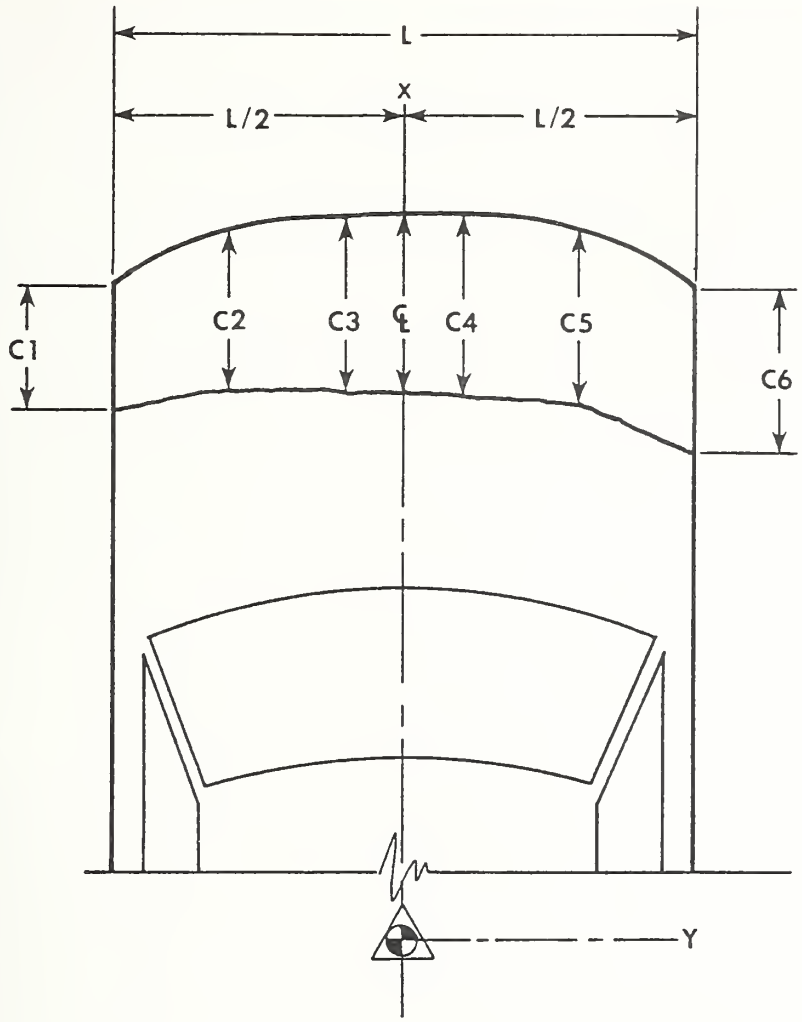
SENSOR #1 TECHNAR, MODEL S6009D001, S/N 27701-3

SENSOR #2 BREED, Model #F134, S/N 7950

CONTACT SWITCH LOCATIONS AND DATA SUMMARY

LOCATION	SEPARATION TIME (MSEC)
VEHICLE CONTACT SWITCH - LEFT	118.2 γ
VEHICLE CONTACT SWITCH - CENTER	--- γ
VEHICLE CONTACT SWITCH - RIGHT	119.0
BARRIER CONTACT SWITCH - LEFT	119.0
BARRIER CONTACT SWITCH - RIGHT	101.0

γ See TEST ANOMALIES



NOTE: L is pre-test length of contact surface.
C1 through C6 are spaced equally apart.
CL is taken at centerline of vehicle.
All measurements are in inches.

Vehicle 1985 Pontiac Grand AM - Test #881017-2

	PRE-TEST*		POST-TEST		CUMULATIVE CRUSH
L	58.0				
C1	172.0	C1	164.9	C1	7.1
C2	174.9	C2	163.1	C2	11.8
C3	176.4	C3	161.9	C3	14.5
C4	176.2	C4	161.8	C4	14.4
C5	174.2	C5	162.4	C5	11.8
C6	171.3	C6	163.2	C6	8.1
CL	176.9	CL	160.8	CL	16.1

*Pre-test measurements taken from test #881017-1.

TEST #881017-2

CAMERA INFORMATION

CAMERA NO.	LOCATION	TYPE	LENS (mm)	SPEED (fps)	PURPOSE OF CAMERA DATA
1	Right side wide	Photosonic 1B	25	501	Impact overall
2	Right side tight	Photosonic 1B	50	499	Impact closeup

SECTION 5.0

TEST #881017-3 SUMMARY

TEST CONDITIONS:

TEST NUMBER: 881017-3

DATE OF TEST: 10/17/88

TIME OF TEST: 1130

AMBIENT TEMPERATURE AT IMPACT AREA: 72° F

SUBJECT VEHICLE DATA:

	ACTUAL	INTENDED
TEST WEIGHT (lbs.)	2998	2990
VEHICLE ORIENTATION (deg.)	0	0
VEHICLE VELOCITY (mph.)	20.0	20.0
MAXIMUM CUMULATIVE CRUSH (in.)	20.9	
AVERAGE CUMULATIVE CRUSH $\{\frac{C1+C6}{2}+C2+C3+C4+C5\}/5$ (in.)	21.6	

VEHICLE ATTITUDES:

POST-TEST: LF: 29.7; RF: 34.6; LR: 27.4; RR: 27.5

TEST NUMBER 881017-3

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

o. LOCATION	X*	Y*	Z*	POSITIVE DIRECTION MAX G	MSEC	NEGATIVE DIRECTION MAX G	MSEC
VEHICLE REAR DECK PRIMARY LONGITUDINAL	52.0	0.0	17.4	2.0	111.5	25.4	40.
VEHICLE REAR DECK REDUNDANT LONGITUDINAL	52.0	1.2	17.4	2 0	112.0	25 2	40.

ALL MEASUREMENTS OF ACCELEROMETER LOCATIONS ARE IN INCHES.

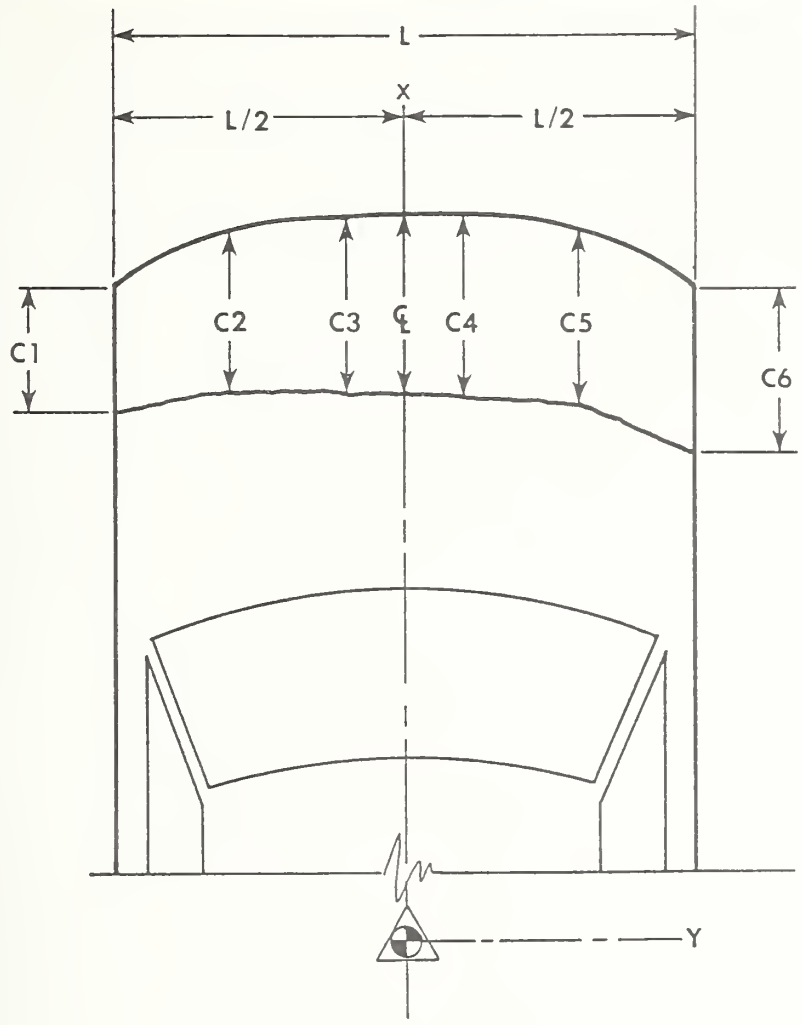
EFERENCE: X: + FORWARD FROM REAR BUMPER
Y: + LEFTWARD FROM VEHICLE CENTERLINE
Z: + UPWARD FROM GROUND LEVEL

TEST #881017-3

CONTACT SWITCH LOCATIONS AND DATA SUMMARY

LOCATION	SEPARATION TIME (MSEC)
VEHICLE CONTACT SWITCH - LEFT	146.0 γ
VEHICLE CONTACT SWITCH - CENTER	--- γ
VEHICLE CONTACT SWITCH - RIGHT	123.8
BARRIER CONTACT SWITCH - LEFT	121.1
BARRIER CONTACT SWITCH - RIGHT	111.2

γ See TEST ANOMALIES



NOTE: L is pre-test length of contact surface.
C1 through C6 are spaced equally apart.
CL is taken at centerline of vehicle.
All measurements are in inches.

Vehicle 1985 Pontic Grand AM - Test #881017-3

	PRE-TEST*		POST-TEST		CUMULATIVE CRUSH
L	58.0				
C1	172.0	C1	159.6	C1	12.4
C2	174.9	C2	156.1	C2	18.8
C3	176.4	C3	155.6	C3	20.8
C4	176.2	C4	155.4	C4	20.8
C5	174.2	C5	156.1	C5	18.1
C6	171.3	C6	155.6	C6	15.7
CL	176.9	CL	156.0	CL	20.9

*Pre-test measurements taken from test #881017-1.

TEST #881017-3

CAMERA INFORMATION

CAMERA NO.	LOCATION	TYPE	LENS (mm)	SPEED (fps)	PURPOSE OF CAMERA DATA
1	Right side wide	Photosonic 1B	25	498	Impact overall
2	Right side tight	Photosonic 1B	50	500	Impact closeup

SECTION 6.0

TEST #881017-4 SUMMARY

TEST CONDITIONS:

TEST NUMBER: 881017-4

DATE OF TEST: 10/17/88

TIME OF TEST: 1320

AMBIENT TEMPERATURE AT IMPACT AREA: 72° F

SUBJECT VEHICLE DATA:

	ACTUAL	INTENDED
TEST WEIGHT (lbs.)	2998	2990
VEHICLE ORIENTATION (deg.)	0	0
VEHICLE VELOCITY (mph.)	18.8	18.4
MAXIMUM CUMULATIVE CRUSH (in.)	27.7	
AVERAGE CUMULATIVE CRUSH $\{\frac{C1+C6}{2}+C2+C3+C4+C5\}/5$ (in.)	24.1	

VEHICLE ATTITUDES:

POST-TEST: LF: 30.9; RF: 36.9; LR: 27.5; RR: 27.6

TEST NUMBER 881017-4

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

. LOCATION	X*	Y*	Z*	POSITIVE DIRECTION MAX G	MSEC	NEGATIVE DIRECTION MAX G	MSEC
VEHICLE REAR DECK PRIMARY LONGITUDINAL	52.0	0.0	17.4	2.7	104.6	27.9	38.6
VEHICLE REAR DECK REDUNDANT LONGITUDINAL	52.0	1.2	17.4	2.6	104.8	28.5	38.0

ALL MEASUREMENTS OF ACCELEROMETER LOCATIONS ARE IN INCHES.

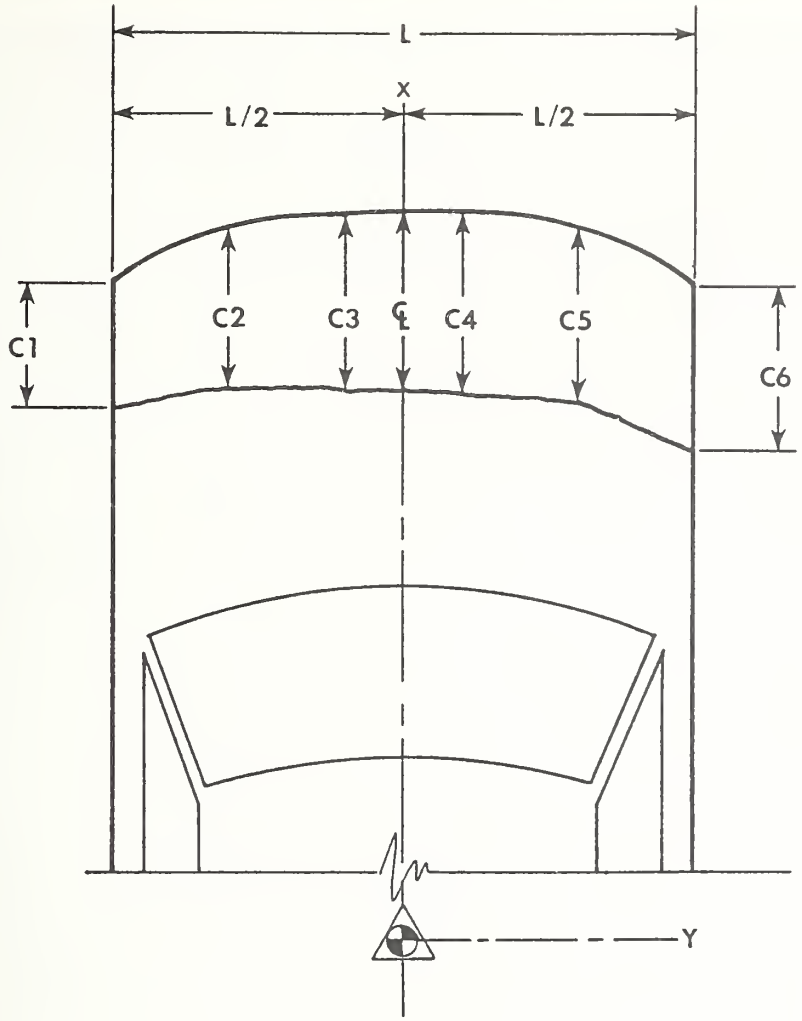
FERENCE: X: + FORWARD FROM REAR BUMPER
Y: + LEFTWARD FROM VEHICLE CENTERLINE
Z: + UPWARD FROM GROUND LEVEL

TEST #881017-4

CONTACT SWITCH LOCATIONS AND DATA SUMMARY

LOCATION	SEPARATION TIME (MSEC)
VEHICLE CONTACT SWITCH - LEFT	105.0 ϒ
VEHICLE CONTACT SWITCH - CENTER	35.0
VEHICLE CONTACT SWITCH - RIGHT	85.0 ϒ
BARRIER CONTACT SWITCH - LEFT	133.5
BARRIER CONTACT SWITCH - RIGHT	77.2

ϒSee TEST ANOMALIES



NOTE: L is pre-test length of contact surface.
C1 through C6 are spaced equally apart.
CL is taken at centerline of vehicle.
All measurements are in inches.

Vehicle 1985 Pontiac Grand AM - Test #881017-4

	PRE-TEST*		POST-TEST		CUMULATIVE CRUSH
L	58.0				
C1	172.0	C1	**148.8	C1	23.2
C2	174.9	C2	151.1	C2	23.8
C3	176.4	C3	151.0	C3	25.4
C4	176.2	C4	150.5	C4	25.7
C5	174.2	C5	150.8	C5	23.4
C6	171.3	C6	150.0	C6	21.3
CL	176.9	CL	149.2	CL	27.7

*Pre-test measurements taken from test #881017-1.

** This measurement was taken with the left front bumper plastic facia removed, since it was bulging outward 6.2 inches from the bumper structure at location C1. Prior to removing this portion of the facia, the C1 measurement was 155.0 inches.

TEST #881017-4

CAMERA INFORMATION

CAMERA NO.	LOCATION	TYPE	LENS (mm)	SPEED (fps)	PURPOSE OF CAMERA DATA
1	Right side wide	Photosonic 1B	25	498	Impact overall
2	Right side tight	Photosonic 1B	50	499	Impact closeup

SECTION 7.0

TEST #881017-5 SUMMARY

TEST CONDITIONS:

TEST NUMBER: 881017-5

DATE OF TEST: 10/17/88

TIME OF TEST: 1435

AMBIENT TEMPERATURE AT IMPACT AREA: 72° F

SUBJECT VEHICLE DATA:

	ACTUAL	INTENDED
TEST WEIGHT (lbs.)	2998	2990
VEHICLE ORIENTATION (deg.)	0	0
VEHICLE VELOCITY (mph.)	30.6	30.0
MAXIMUM CUMULATIVE CRUSH (in.)	39.5	
AVERAGE CUMULATIVE CRUSH $\{\frac{C1+C6}{2}+C2+C3+C4+C5\}/5$ (in.)	36.8	

VEHICLE ATTITUDES:

POST-TEST: LF: 32.5; RF: 41.0; LR: 26.6; RR: 26.4

TEST NUMBER 881017-5

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

LOCATION	X*	Y*	Z*	POSITIVE DIRECTION MAX G	MSEC	NEGATIVE DIRECTION MAX G	MSEC
VEHICLE REAR DECK PRIMARY LONGITUDINAL	52.0	0.0	17.4	3.0	296.8	36.3	39.1
VEHICLE REAR DECK REDUNDANT LONGITUDINAL	52.0	1.2	17.4	2.3	297.9	37.0	39.3

ALL MEASUREMENTS OF ACCELEROMETER LOCATIONS ARE IN INCHES.

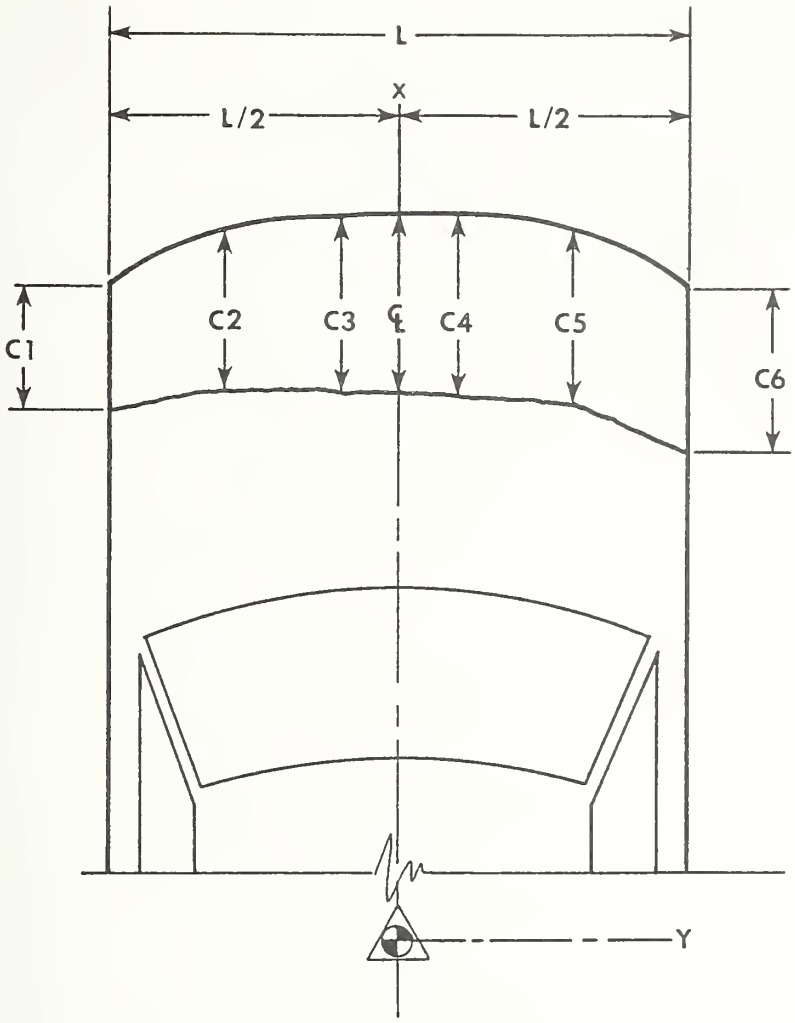
FERENCE: X: + FORWARD FROM REAR BUMPER
Y: + LEFTWARD FROM VEHICLE CENTERLINE
Z: + UPWARD FROM GROUND LEVEL

TEST #881017-5

CONTACT SWITCH LOCATIONS AND DATA SUMMARY

LOCATION	SEPARATION TIME (MSEC)
VEHICLE CONTACT SWITCH - LEFT	132.8
VEHICLE CONTACT SWITCH - CENTER	80.5 γ
VEHICLE CONTACT SWITCH - RIGHT	120.5 γ
BARRIER CONTACT SWITCH - LEFT	152.0 γ
BARRIER CONTACT SWITCH - RIGHT	62.1 γ

γ See TEST ANOMALIES



NOTE: L is pre-test length of contact surface.
C1 through C6 are spaced equally apart.
CL is taken at centerline of vehicle.
All measurements are in inches.

Vehicle 1985 Pontiac Grand AM - Test #881017-5

	PRE-TEST*		POST-TEST		CUMULATIVE CRUSH
L	58.0				
C1	172.0	C1	132.5	C1	39.5
C2	174.9	C2	137.5	C2	37.4
C3	176.4	C3	138.8	C3	37.6
C4	176.2	C4	138.6	C4	37.6
C5	174.2	C5	139.0	C5	35.2
C6	171.3	C6	138.8	C6	32.5
CL	176.9	CL	137.5	CL	39.4

*Pre-test measurements taken from test #881017-1.

TEST #881017-5

CAMERA INFORMATION

CAMERA NO.	LOCATION	TYPE	LENS (mm)	SPEED (fps)	PURPOSE OF CAMERA DATA
1	Right side wide	Photosonic 1B	25	500	Impact overall
2	Right side tight	Photosonic 1B	50	500	Impact closeup

APPENDIX A

PHOTOGRAPHS

TEST #881017-1

LIST OF PHOTOGRAPHS

1. PRE-TEST OVERALL LEFT SIDE VIEW
2. POST-TEST OVERALL LEFT SIDE VIEW
3. PRE-TEST OVERALL RIGHT SIDE VIEW
4. POST-TEST OVERALL RIGHT SIDE VIEW
5. PRE-TEST OVERALL FRONT VIEW
6. POST-TEST OVERALL FRONT VIEW
7. PRE-TEST OVERALL REAR VIEW
8. POST-TEST OVERALL REAR VIEW
9. PRE-TEST LEFT FRONT VIEW
10. POST-TEST LEFT FRONT VIEW
11. PRE-TEST RIGHT FRONT VIEW
12. POST-TEST RIGHT FRONT VIEW
13. PRE-TEST BARRIER CONTACT SWITCH
14. PRE-TEST BARRIER CONTACT SWITCH

Figure A-1. PRE-TEST OVERALL LEFT SIDE VIEW

Figure A-2. POST-TEST OVERALL LEFT SIDE VIEW

Figure A-3. PRE-TEST OVERALL RIGHT SIDE VIEW

Figure A-4. POST-TEST OVERALL RIGHT SIDE VIEW

Figure A-5. PRE-TEST OVERALL FRONT VIEW

Figure A-6. POST-TEST OVERALL FRONT VIEW

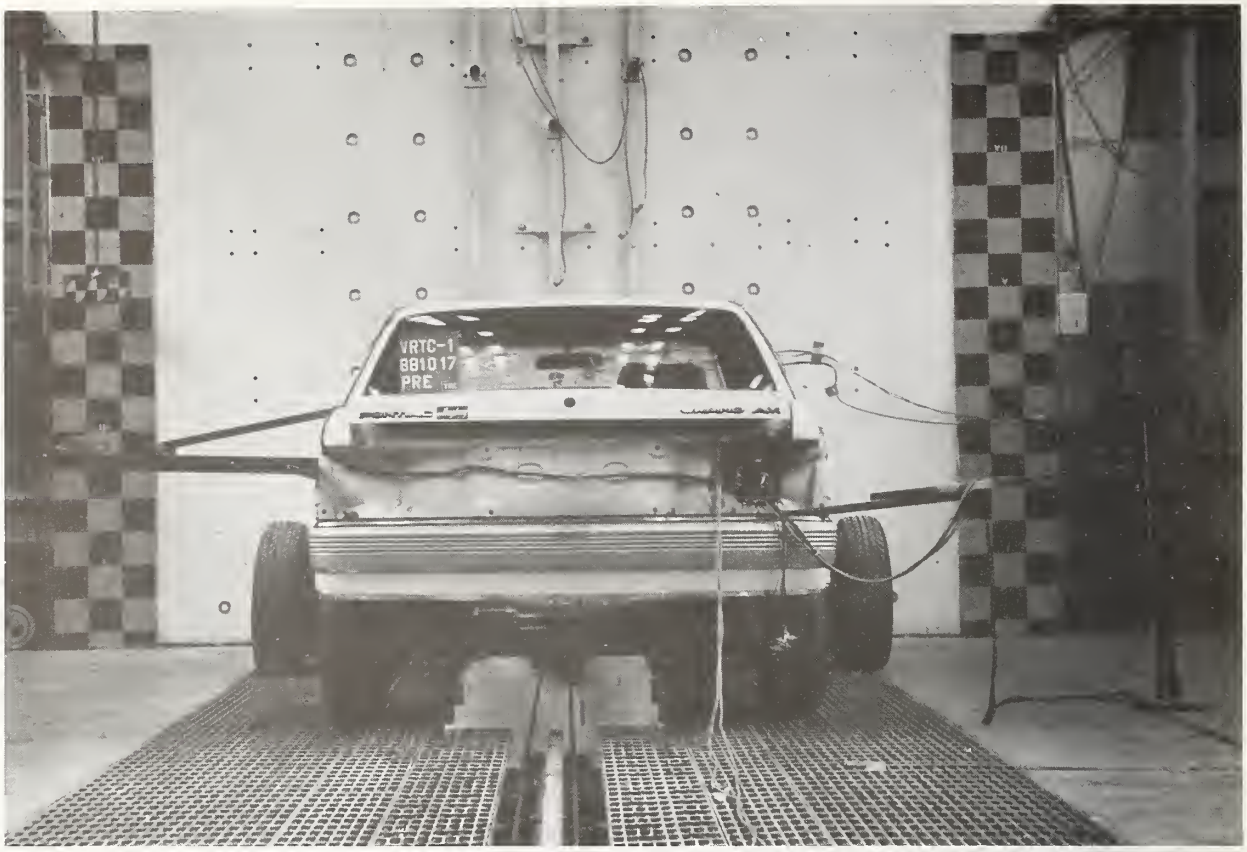


Figure A-7. PRE-TEST OVERALL REAR VIEW

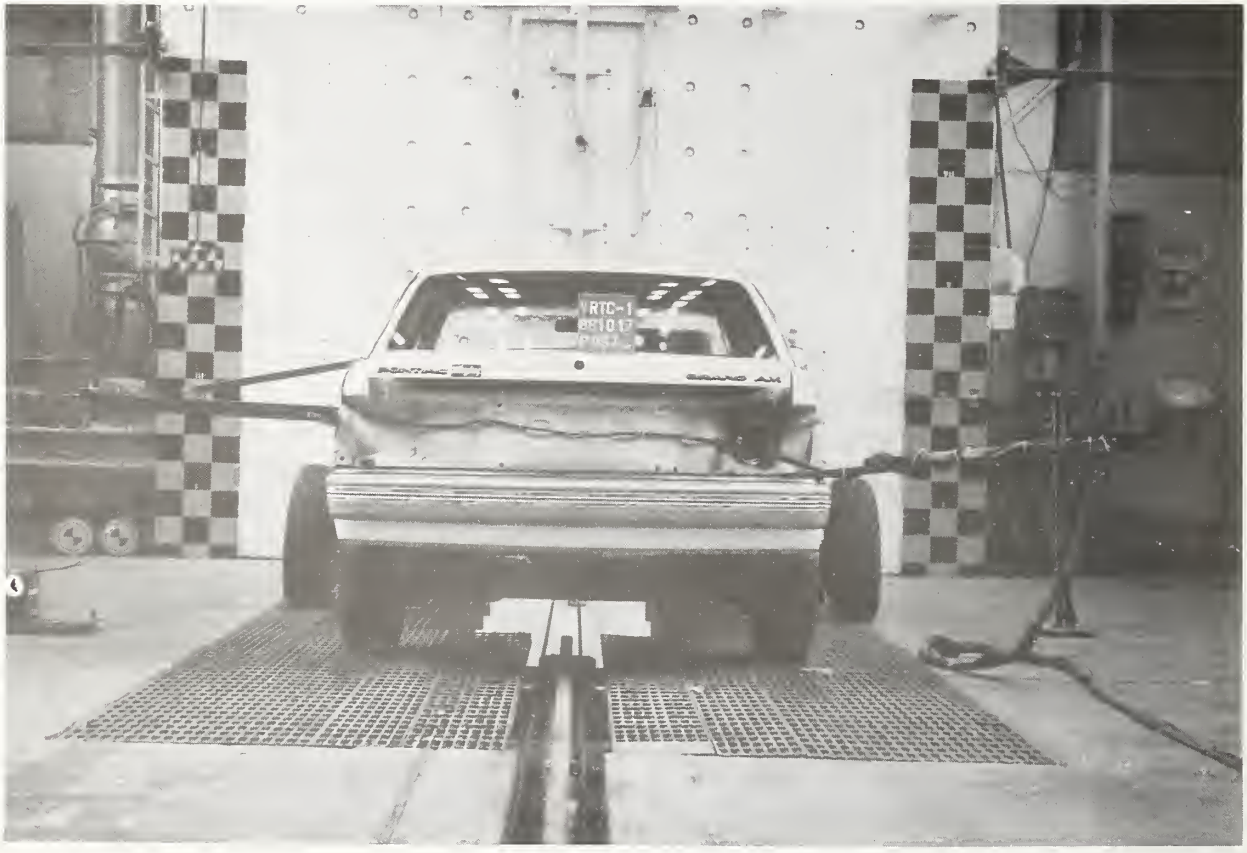


Figure A-8. POST-TEST OVERALL REAR VIEW

Figure A-9. PRE-TEST LEFT FRONT VIEW

Figure A-10. POST-TEST LEFT FRONT VIEW

Figure A-11. PRE-TEST RIGHT FRONT VIEW

Figure A-12. POST-TEST RIGHT FRONT VIEW

Figure A-13. PRE-TEST BARRIER CONTACT SWITCH

Figure A-14. PRE-TEST BARRIER CONTACT SWITCH

TEST #881017-2

LIST OF PHOTOGRAPHS

15. POST-TEST OVERALL LEFT SIDE VIEW
16. POST-TEST OVERALL RIGHT SIDE VIEW
17. POST-TEST OVERALL FRONT VIEW
18. POST-TEST OVERALL REAR VIEW
19. POST-TEST LEFT FRONT VIEW
20. POST-TEST RIGHT FRONT VIEW

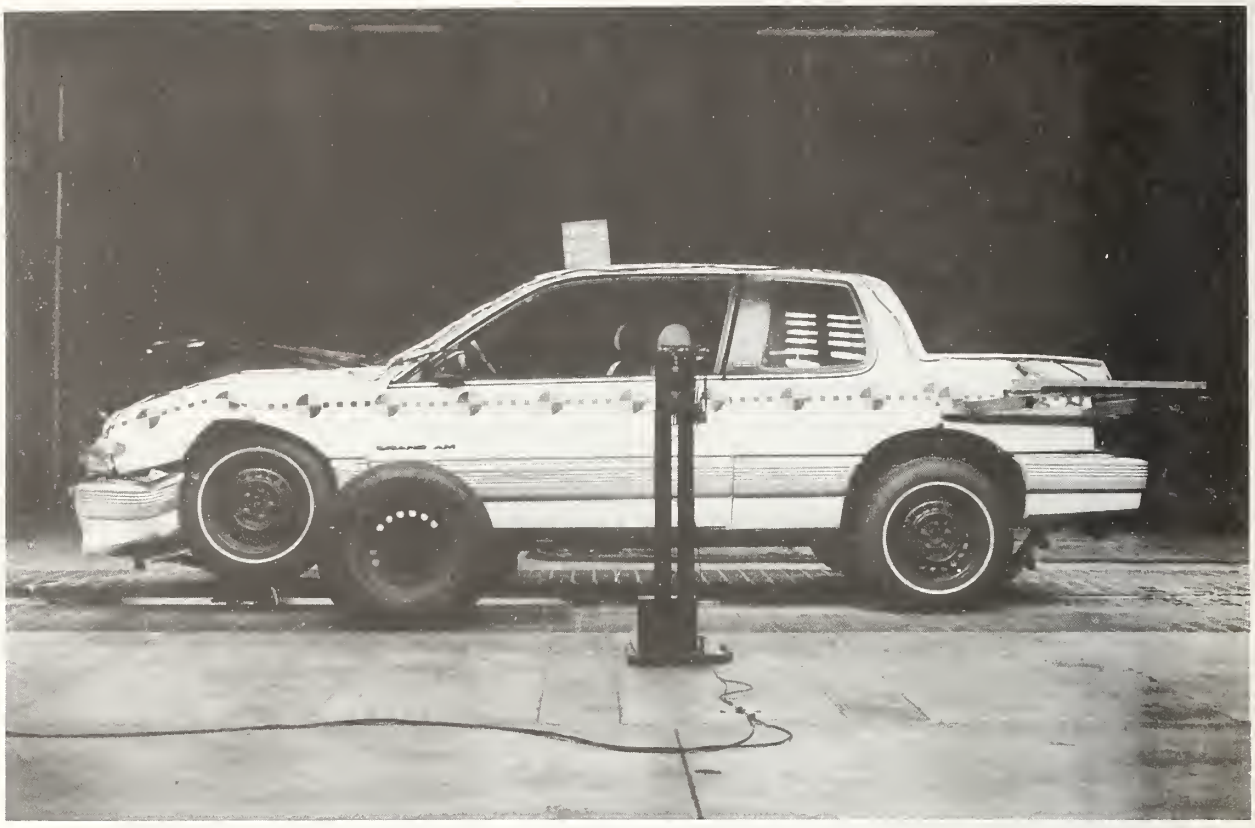


Figure A-15. POST-TEST OVERALL LEFT SIDE VIEW

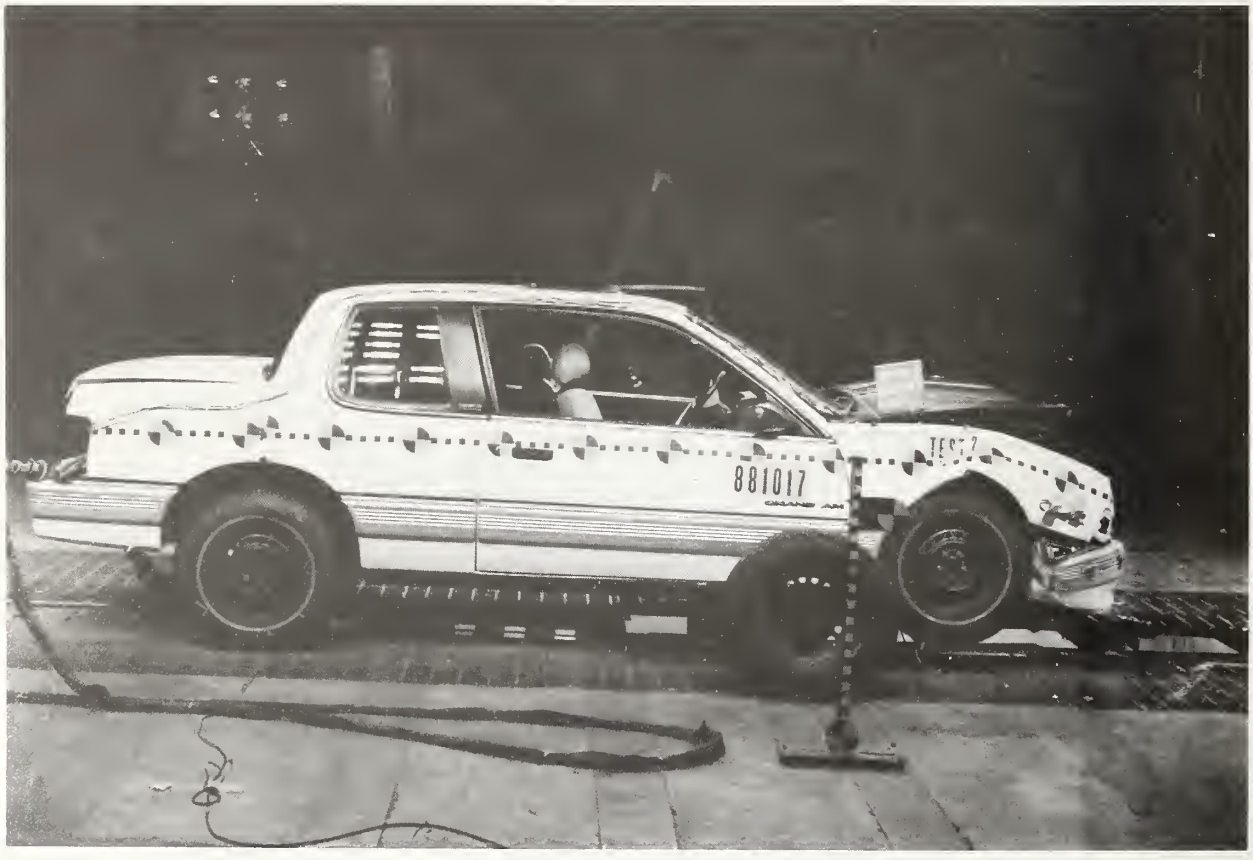


Figure A-16. POST-TEST OVERALL RIGHT SIDE VIEW

Figure A-17. POST-TEST OVERALL FRONT VIEW

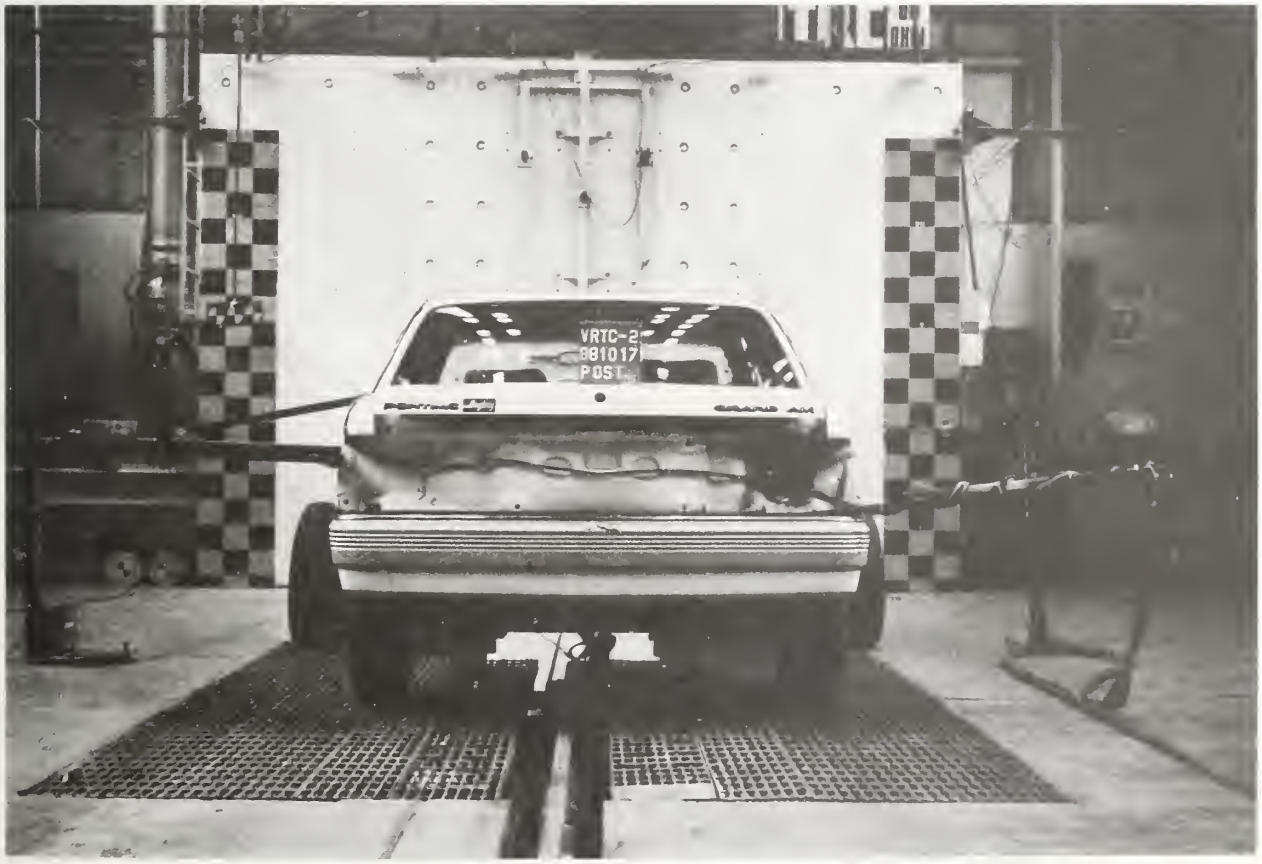


Figure A-18. POST-TEST OVERALL REAR VIEW

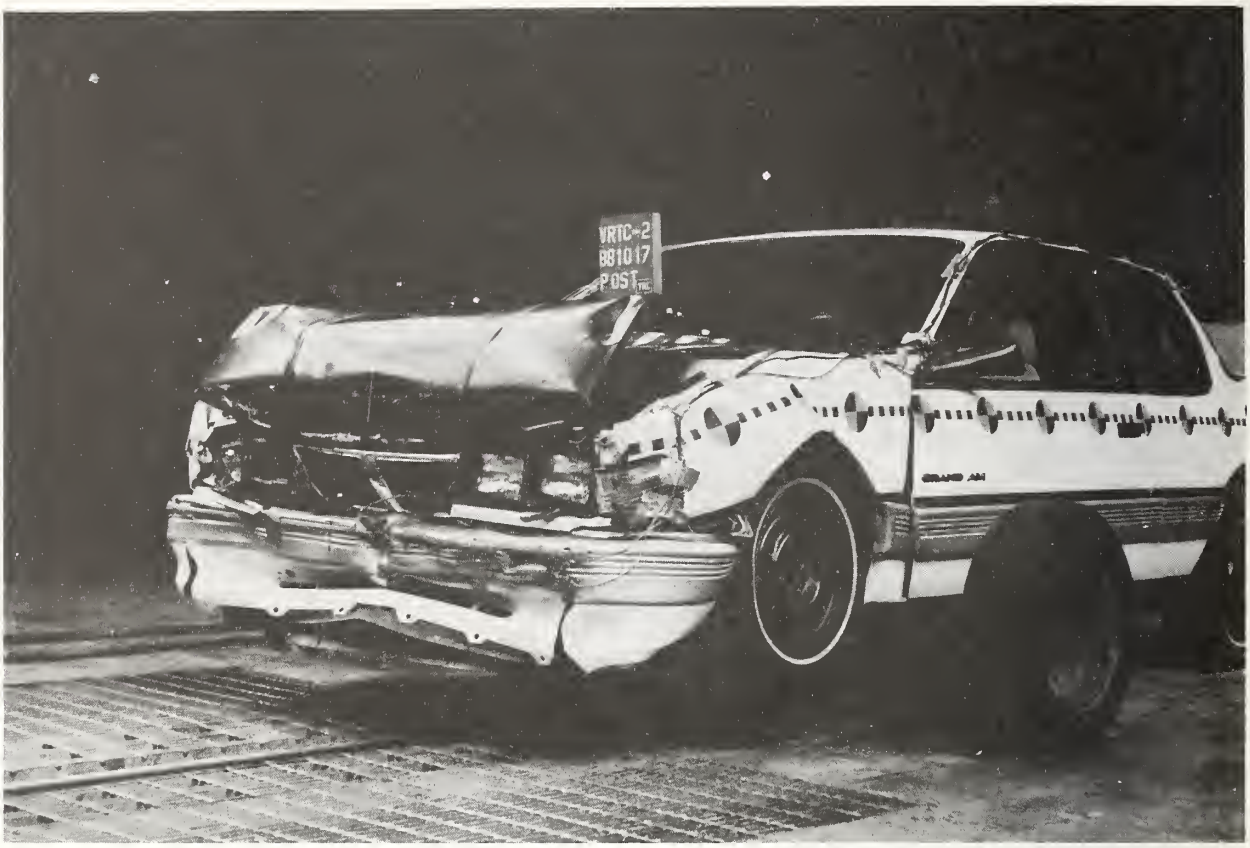


Figure A-19. POST-TEST LEFT FRONT VIEW

Figure A-20. POST-TEST RIGHT FRONT VIEW

TEST #881017-3

LIST OF PHOTOGRAPHS

21. POST-TEST OVERALL LEFT SIDE VIEW
22. POST-TEST OVERALL RIGHT SIDE VIEW
23. POST-TEST OVERALL FRONT VIEW
24. POST-TEST OVERALL REAR VIEW
25. POST-TEST LEFT FRONT VIEW
26. POST-TEST RIGHT FRONT VIEW
27. POST-TEST VEHICLE CLOSE-UP - VIEW 1
28. POST-TEST VEHICLE CLOSE-UP - VIEW 2
29. POST-TEST VEHICLE CLOSE-UP - VIEW 3
30. POST-TEST VEHICLE CLOSE-UP - VIEW 4

Figure A-21. POST-TEST OVERALL LEFT SIDE VIEW

Figure A-22. POST-TEST OVERALL RIGHT SIDE VIEW

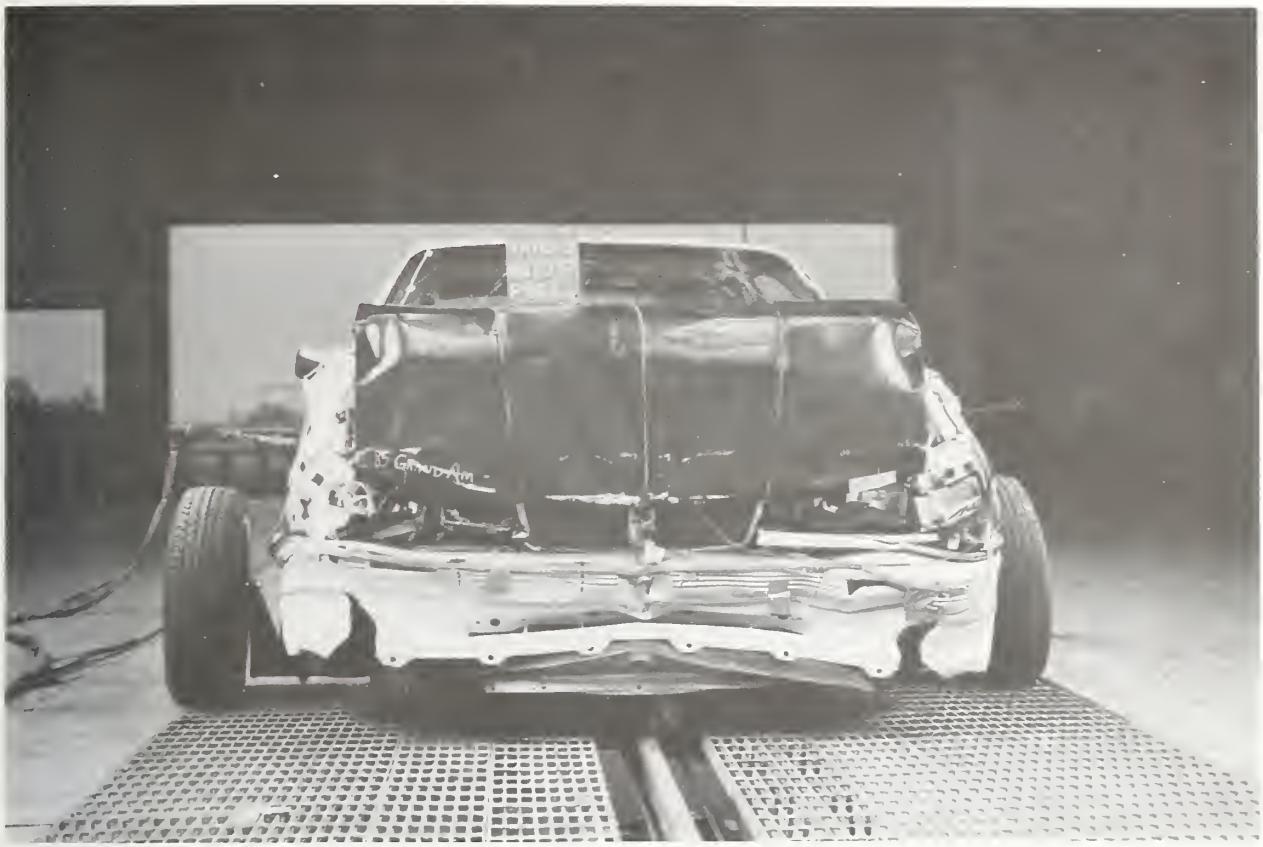


Figure A-23. POST-TEST OVERALL FRONT VIEW

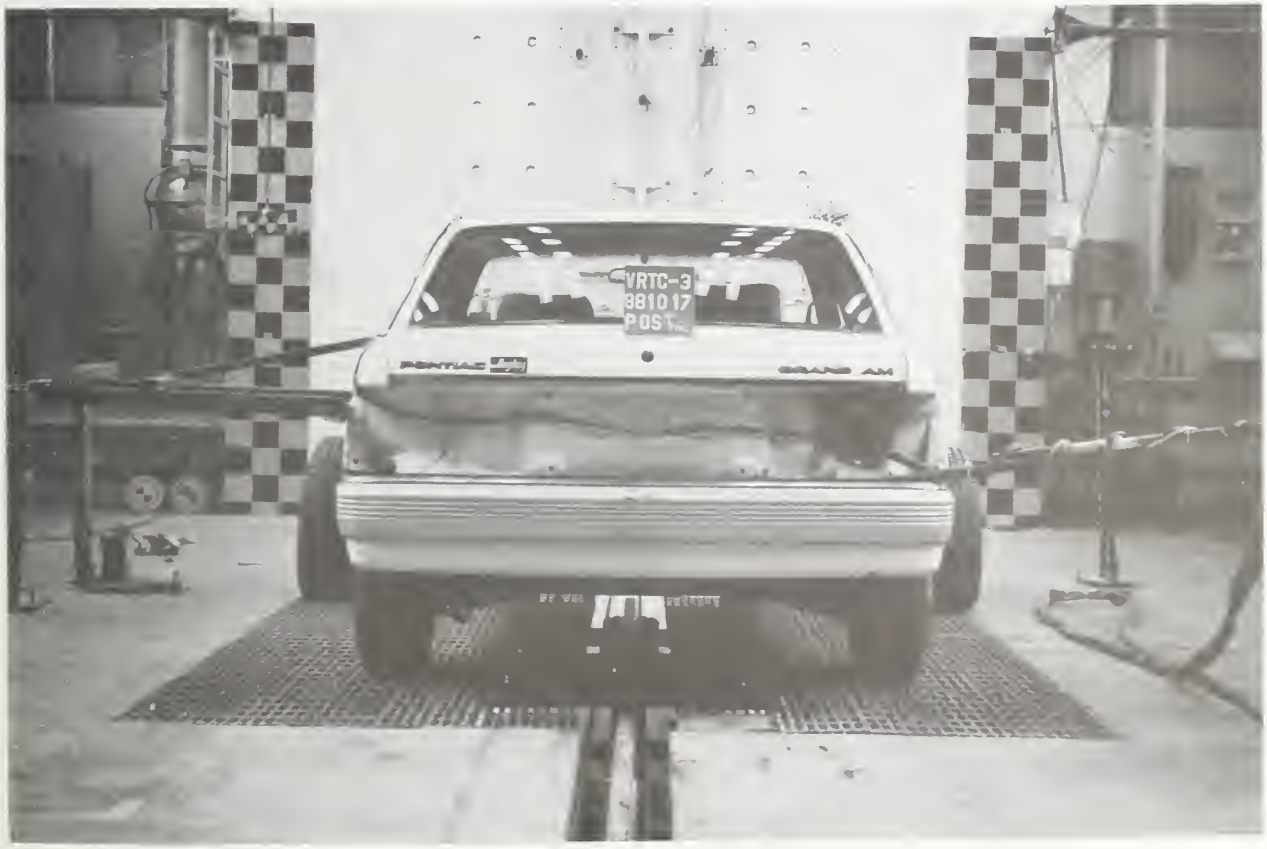


Figure A-24. POST-TEST OVERALL REAR VIEW

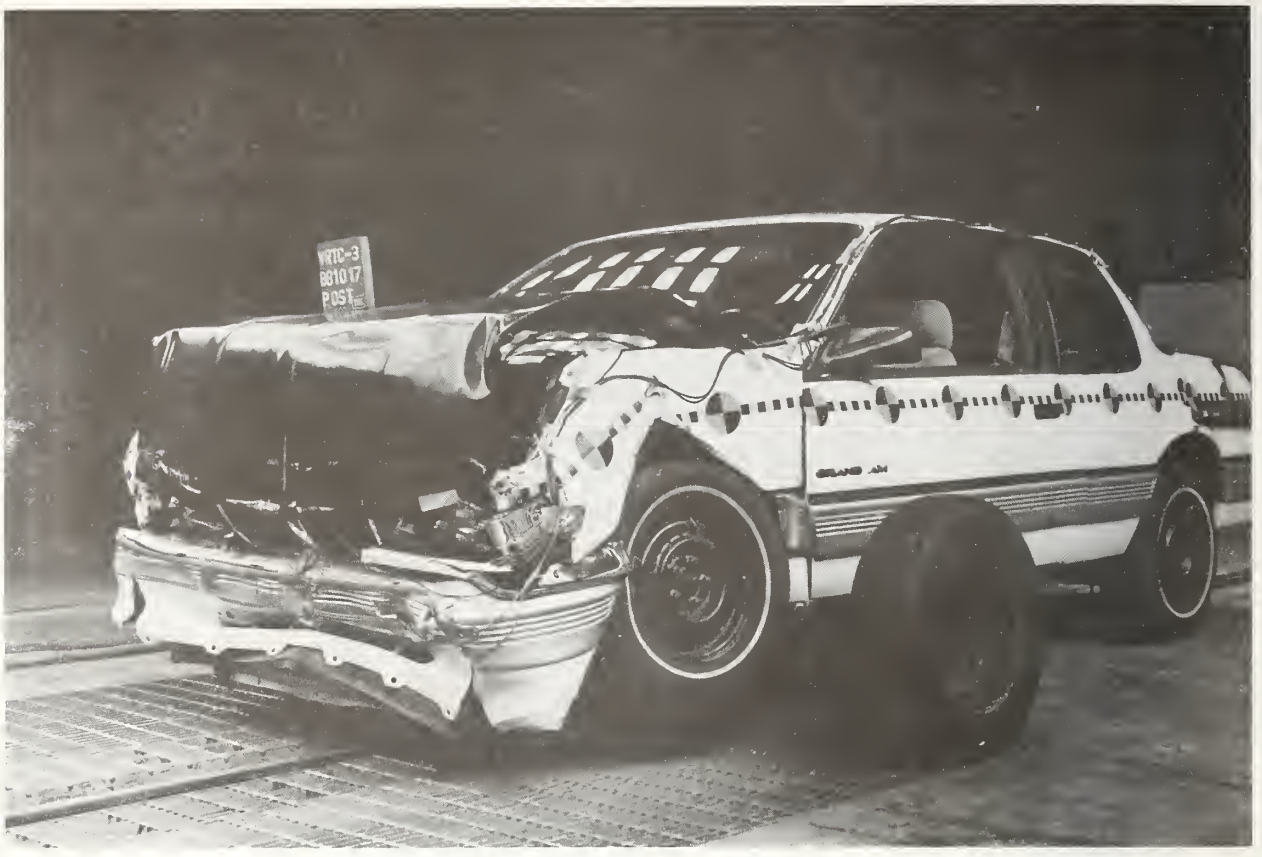


Figure A-25. POST-TEST LEFT FRONT VIEW

Figure A-26. POST-TEST RIGHT FRONT VIEW

Figure A-27. POST-TEST VEHICLE CLOSE-UP - VIEW 1

Figure A-28. POST-TEST VEHICLE CLOSE-UP - VIEW 2

Figure A-29. POST-TEST VEHICLE CLOSE-UP - VIEW 3

Figure A-30. POST-TEST VEHICLE CLOSE-UP - VIEW 4

TEST #881017-4

LIST OF PHOTOGRAPHS

31. POST-TEST OVERALL LEFT SIDE VIEW
32. POST-TEST OVERALL RIGHT SIDE VIEW
33. POST-TEST OVERALL FRONT VIEW
34. POST-TEST OVERALL REAR VIEW
35. POST-TEST LEFT FRONT VIEW
36. POST-TEST RIGHT FRONT VIEW
37. POST-TEST VEHICLE CLOSE-UP - VIEW 1
38. POST-TEST VEHICLE CLOSE-UP - VIEW 2

Figure A-31. POST-TEST OVERALL LEFT SIDE VIEW

Figure A-32. POST-TEST OVERALL RIGHT SIDE VIEW

Figure A-33. POST-TEST OVERALL FRONT VIEW

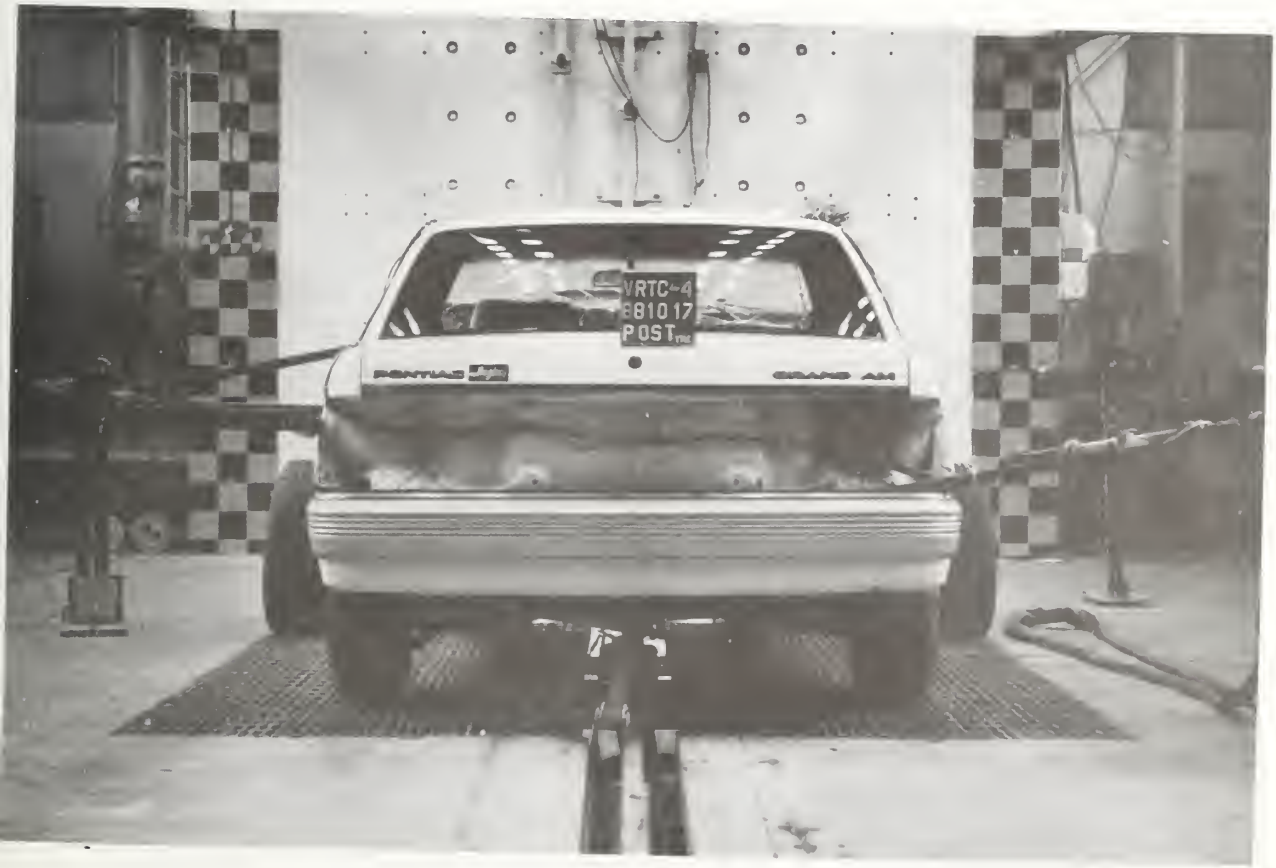


Figure A-34. POST-TEST OVERALL REAR VIEW

Figure A-35. POST-TEST LEFT FRONT VIEW

Figure A-36. POST-TEST RIGHT FRONT VIEW

Figure A-37. POST-TEST VEHICLE CLOSEUP - VIEW 1

Figure A-38. POST-TEST VEHICLE CLOSEUP - VIEW 2

TEST #881017-5

LIST OF PHOTOGRAPHS

39. POST-TEST OVERALL LEFT SIDE VIEW
40. POST-TEST OVERALL RIGHT SIDE VIEW
41. POST-TEST OVERALL FRONT VIEW
42. POST-TEST OVERALL REAR VIEW
43. POST-TEST LEFT FRONT VIEW
44. POST-TEST RIGHT FRONT VIEW
45. POST-TEST BARRIER CONTACT SWITCH
46. POST-TEST VEHICLE CLOSEUP - VIEW 1
47. POST-TEST VEHICLE CLOSEUP - VIEW 2

Figure A-39. POST-TEST OVERALL LEFT SIDE VIEW

Figure A-40. POST-TEST OVERALL RIGHT SIDE VIEW

Figure A-41. POST-TEST OVERALL FRONT VIEW

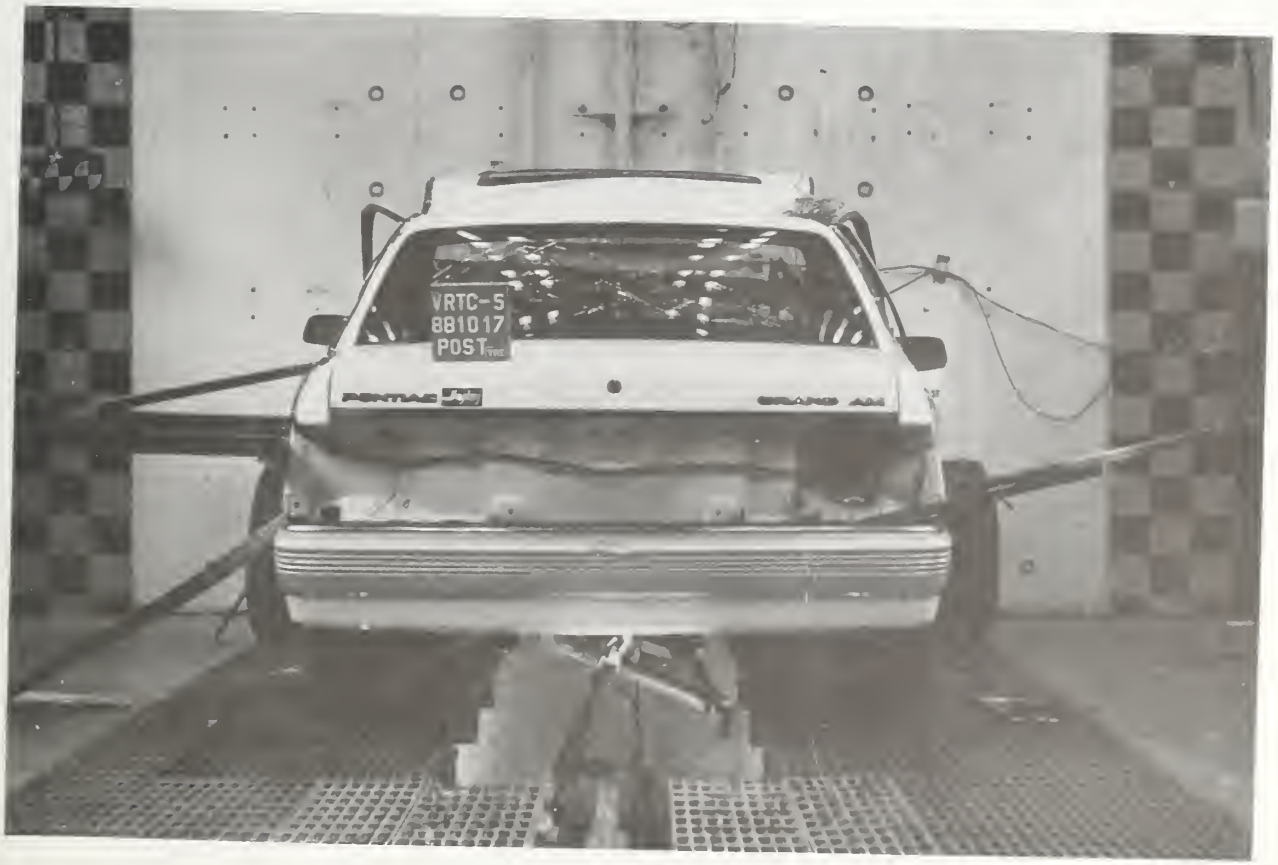


Figure A-42. POST-TEST OVERALL REAR VIEW

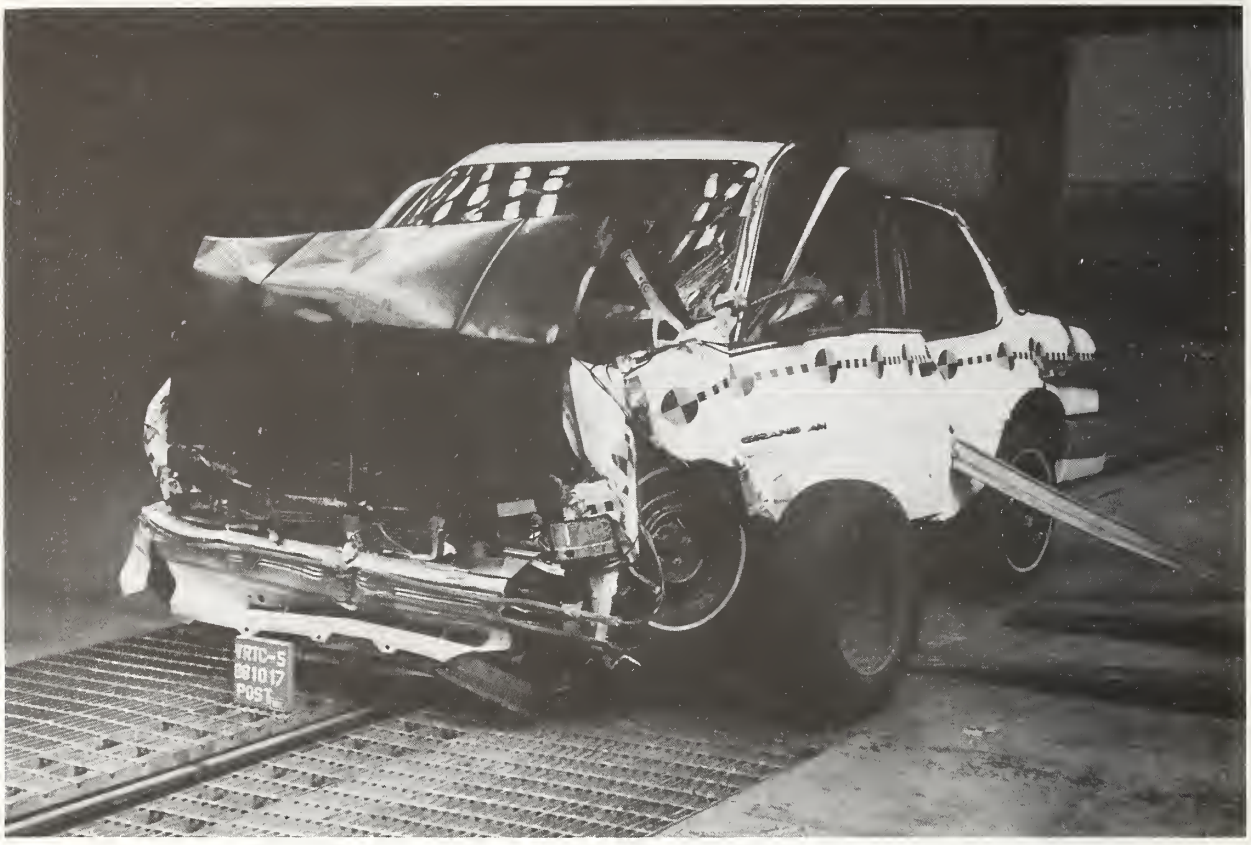


Figure A-43. POST-TEST LEFT FRONT VIEW

Figure A-44. POST-TEST RIGHT FRONT VIEW

Figure A-45. POST-TEST BARRIER CONTACT SWITCH

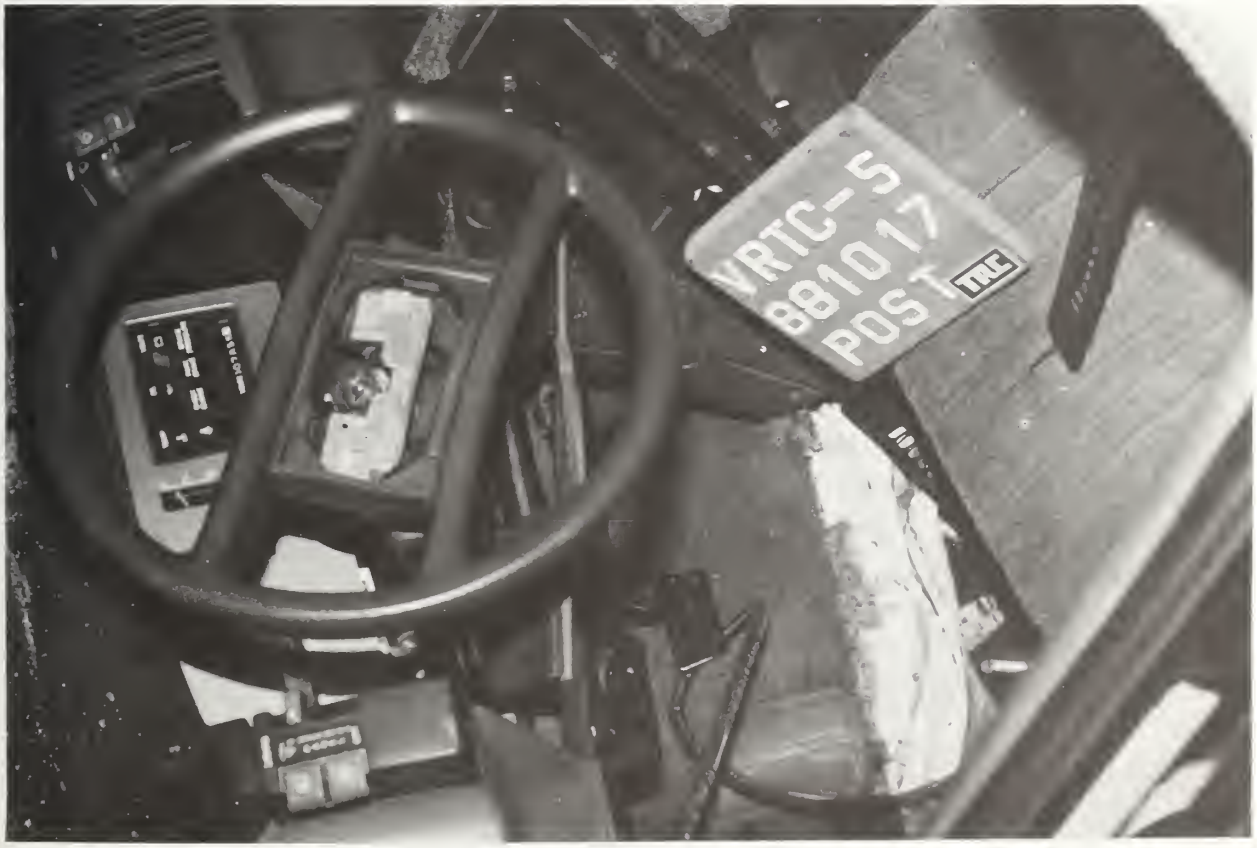
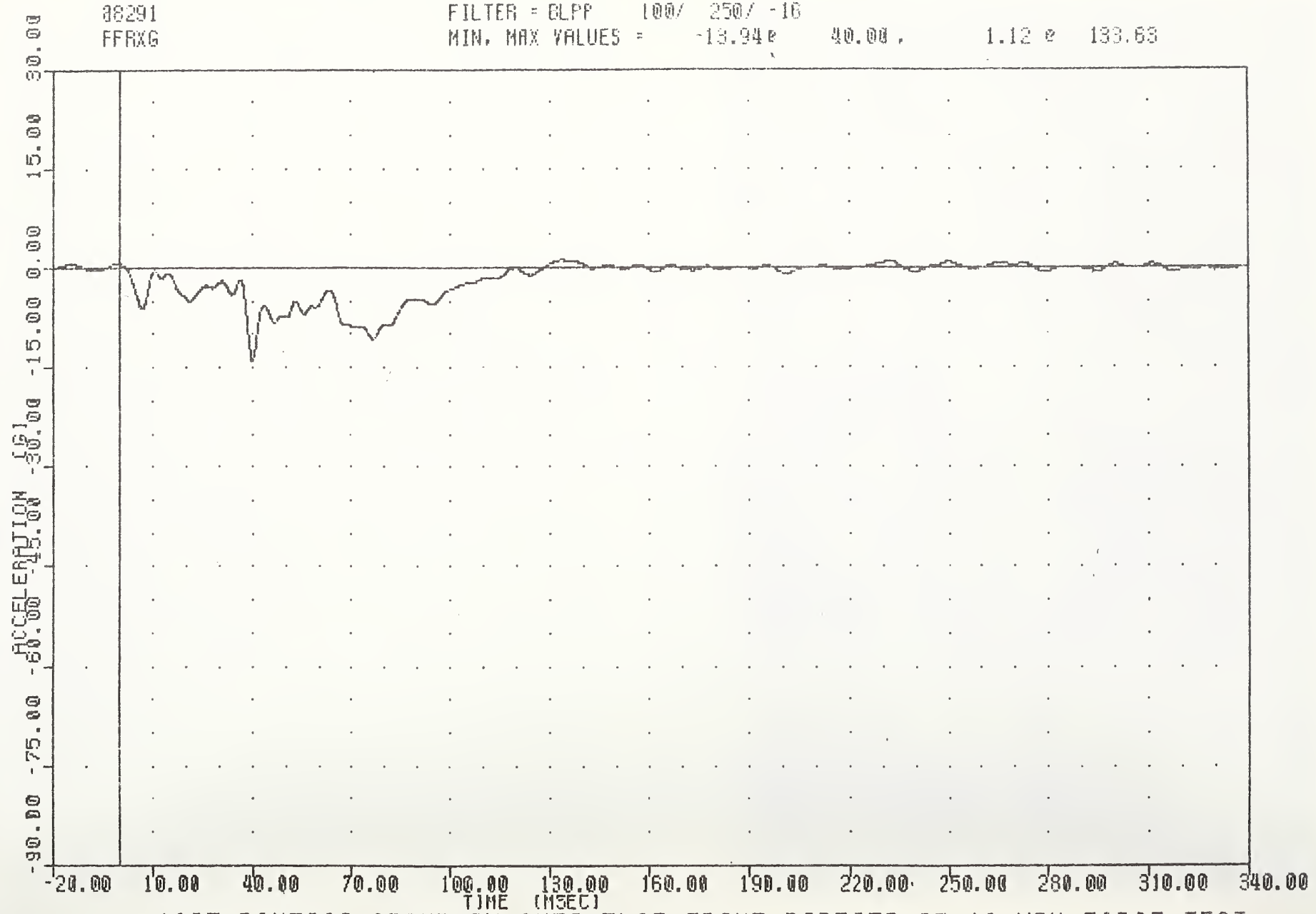


Figure A-46. POST-TEST VEHICLE CLOSEUP - VIEW 1

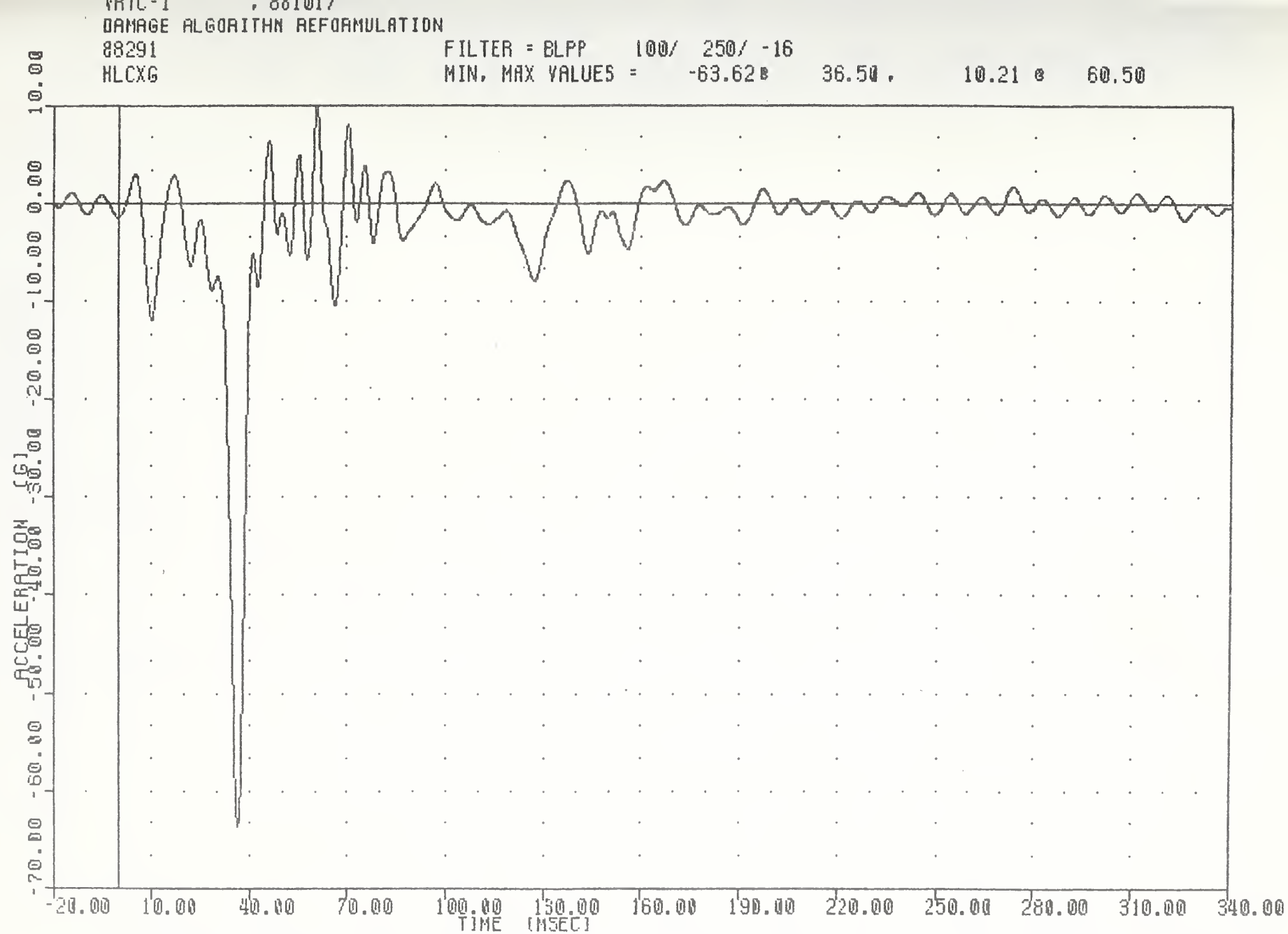
Figure A-47. POST-TEST VEHICLE CLOSEUP - VIEW 2

APPENDIX B

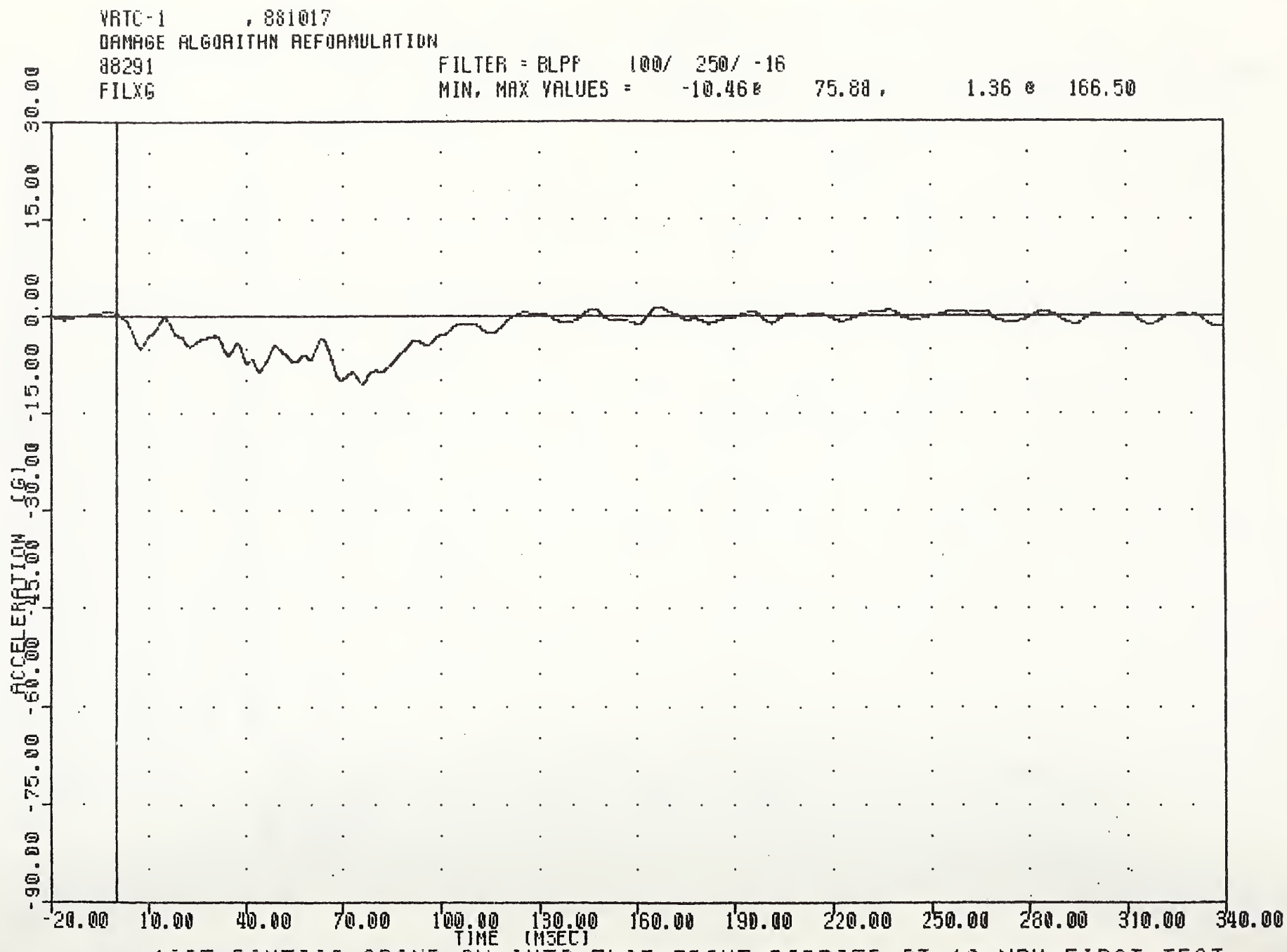
DATA PLOTS



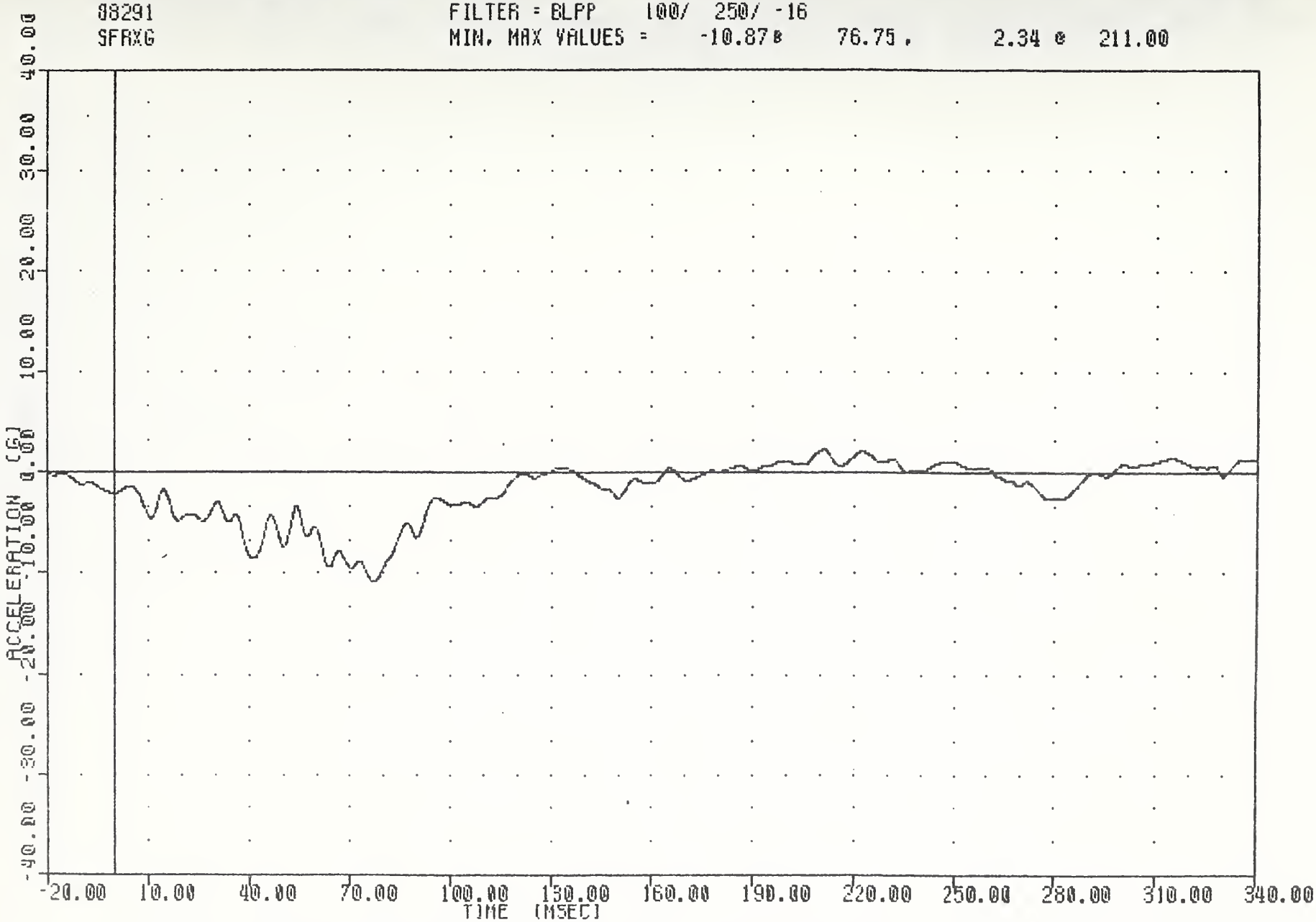
1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 10 MPH FIRST TEST
VEHICLE LEFT FRAME RAIL FRONT X AXIS ACCELERATION



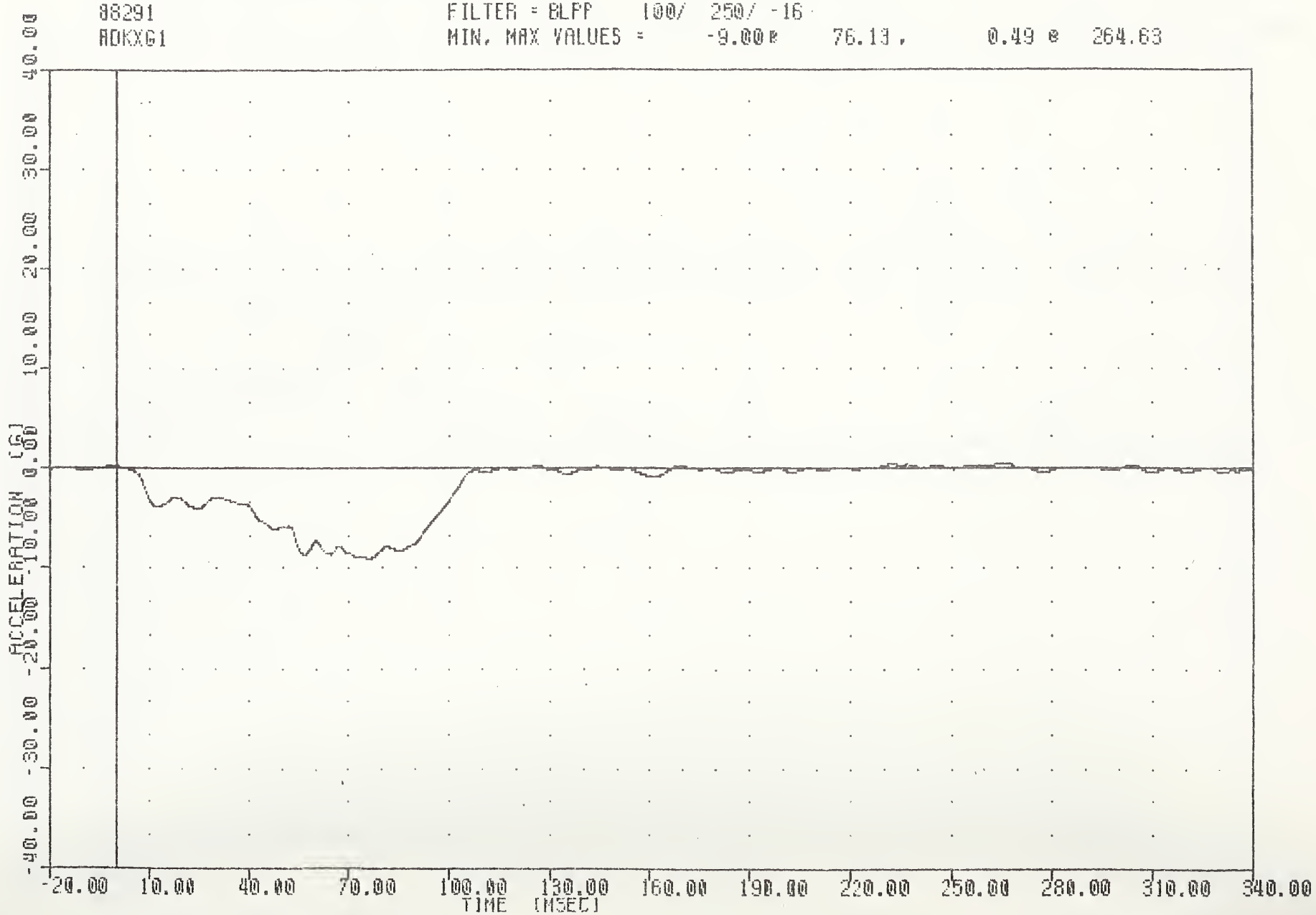
1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 10 MPH FIRST TEST
VEHICLE HOOD LATCH CROSSMEMBER X AXIS ACCELERATION



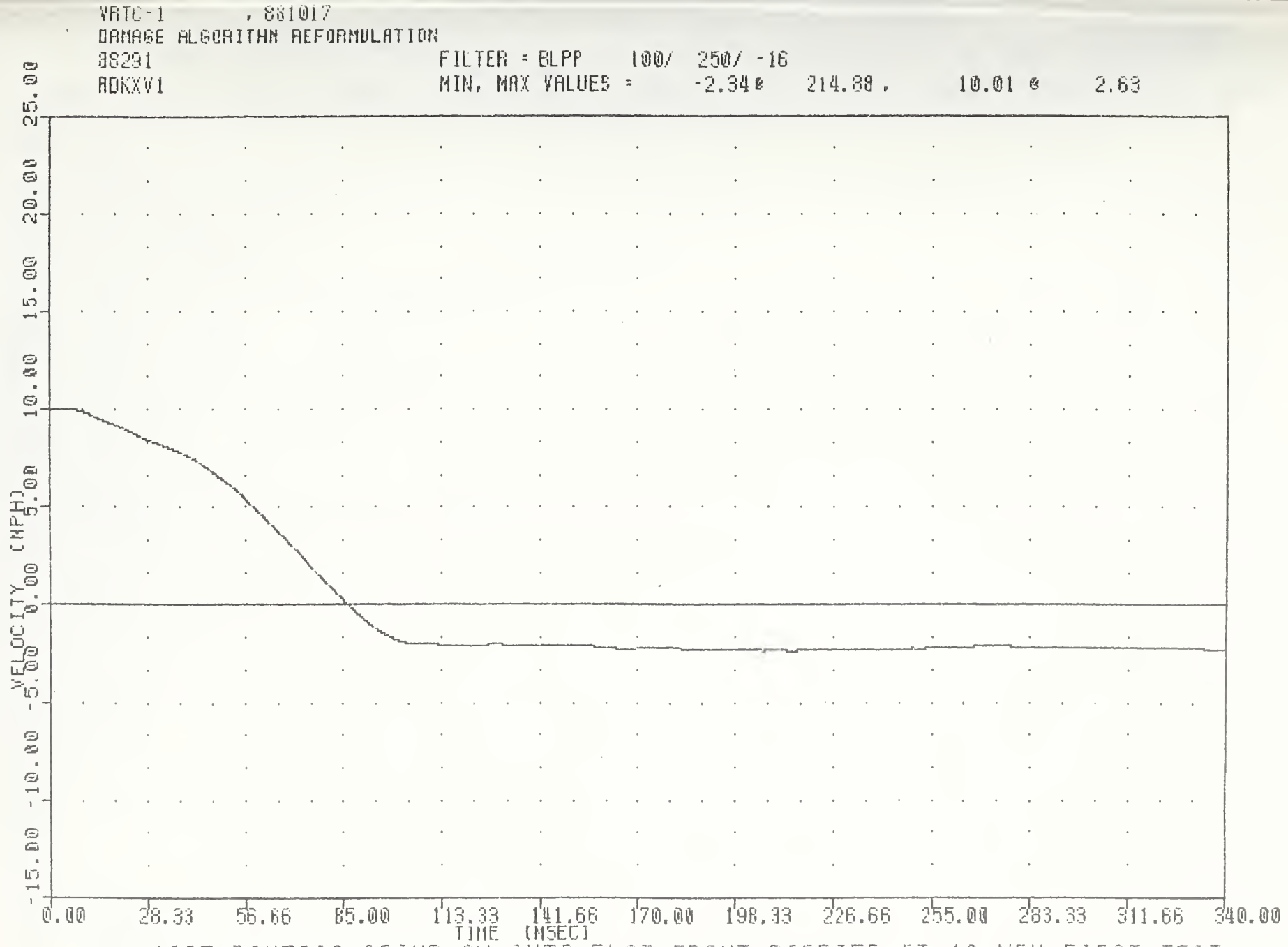
1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 10 MPH FIRST TEST
VEHICLE LEFT FENDER WELL INSIDE X AXIS ACCELERATION



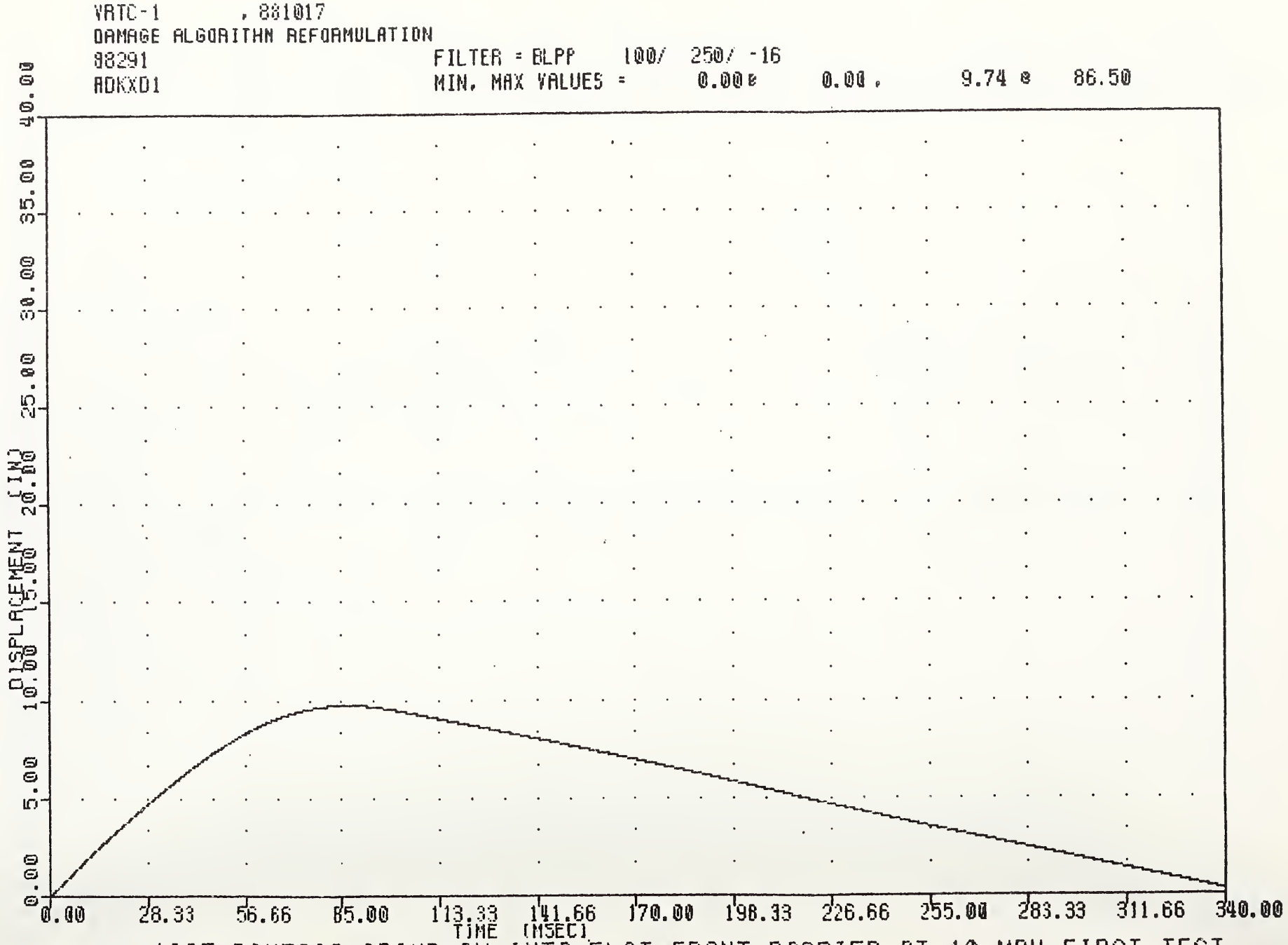
1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 10 MPH FIRST TEST
VEHICLE SUSPENSION FRONT RIGHT X AXIS ACCELERATION



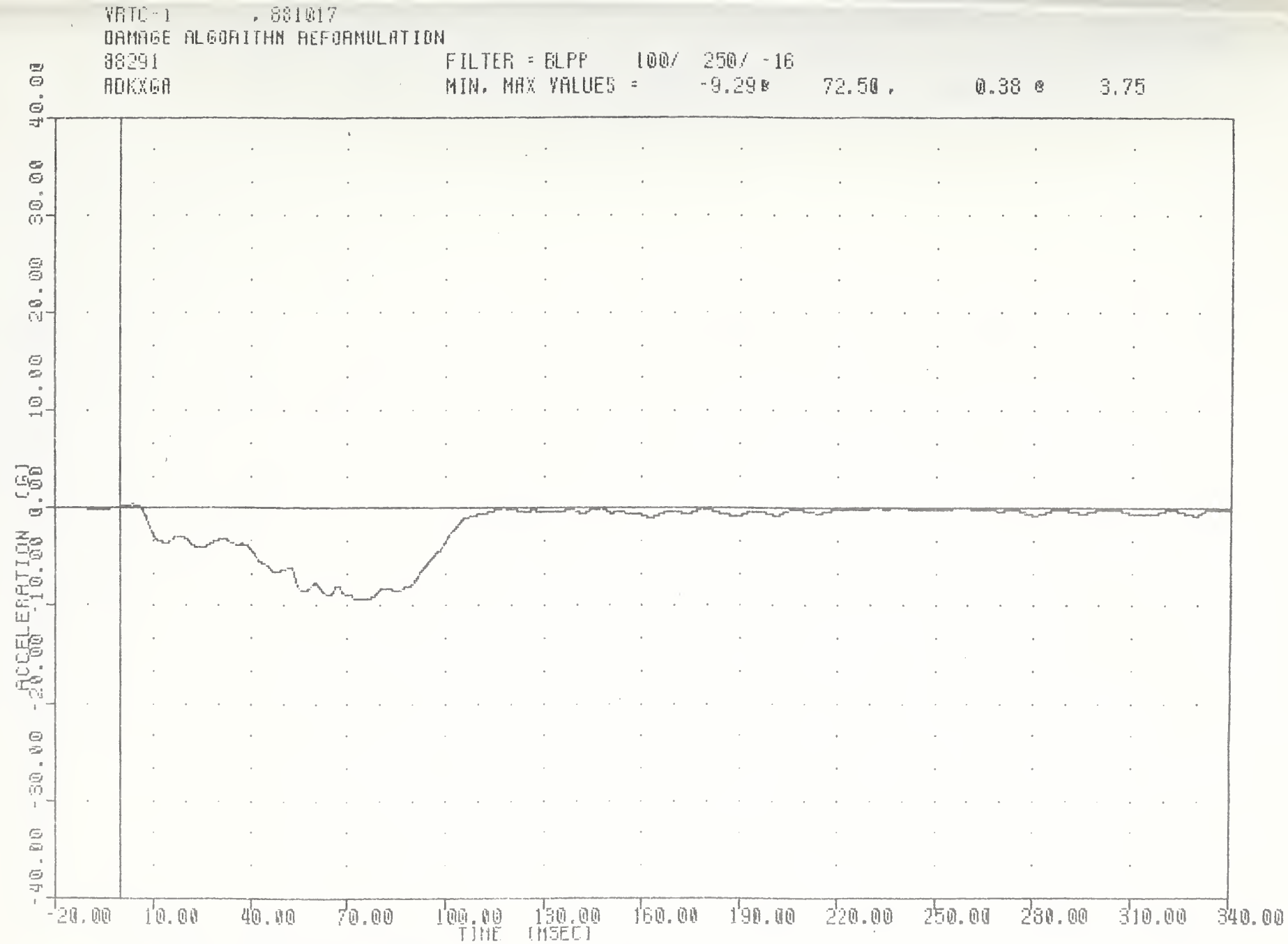
1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 10 MPH FIRST TEST
VEHICLE REAR DECK X AXIS ACCELERATION



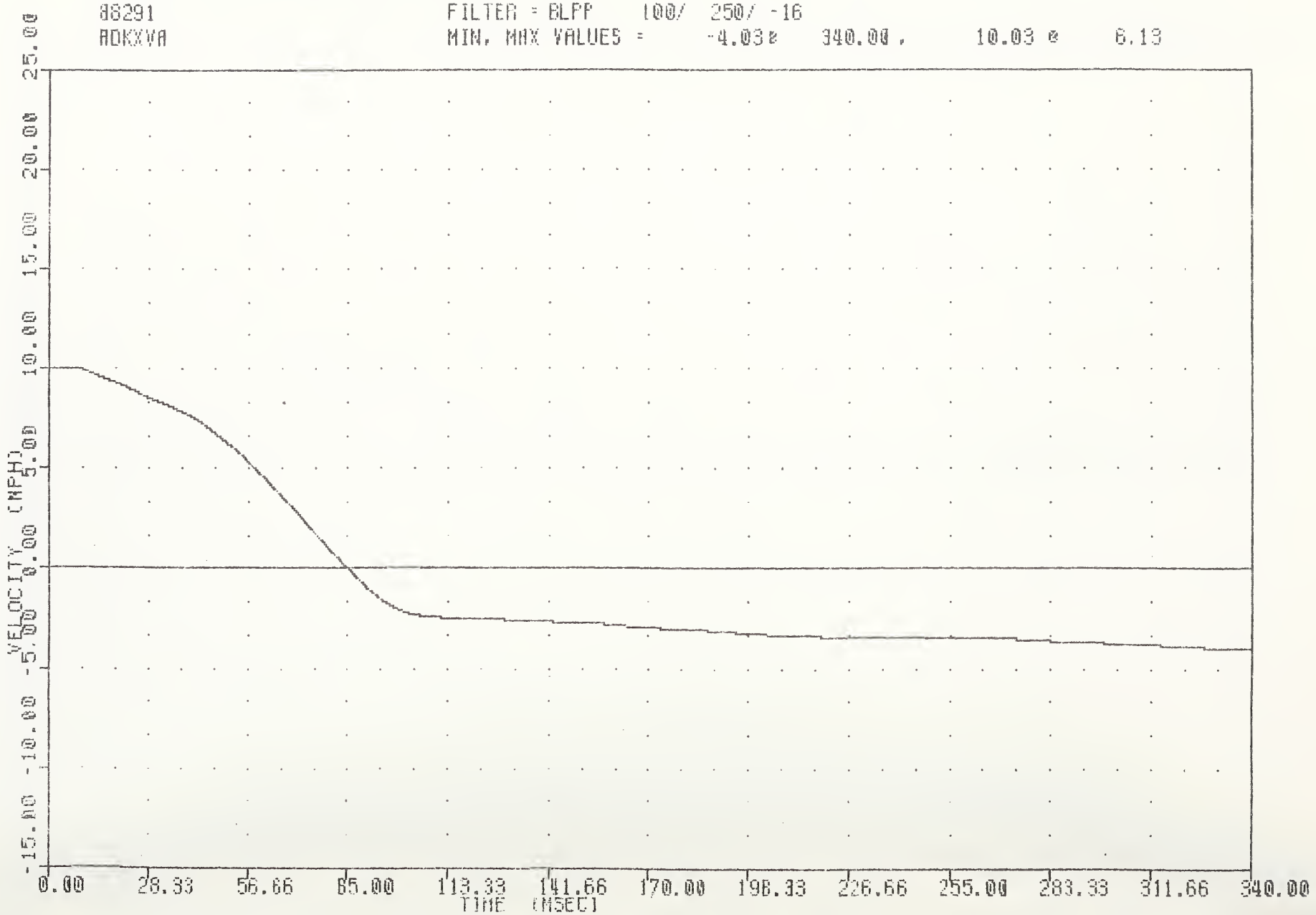
1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 10 MPH FIRST TEST
VEHICLE REAR DECK X AXIS VELOCITY



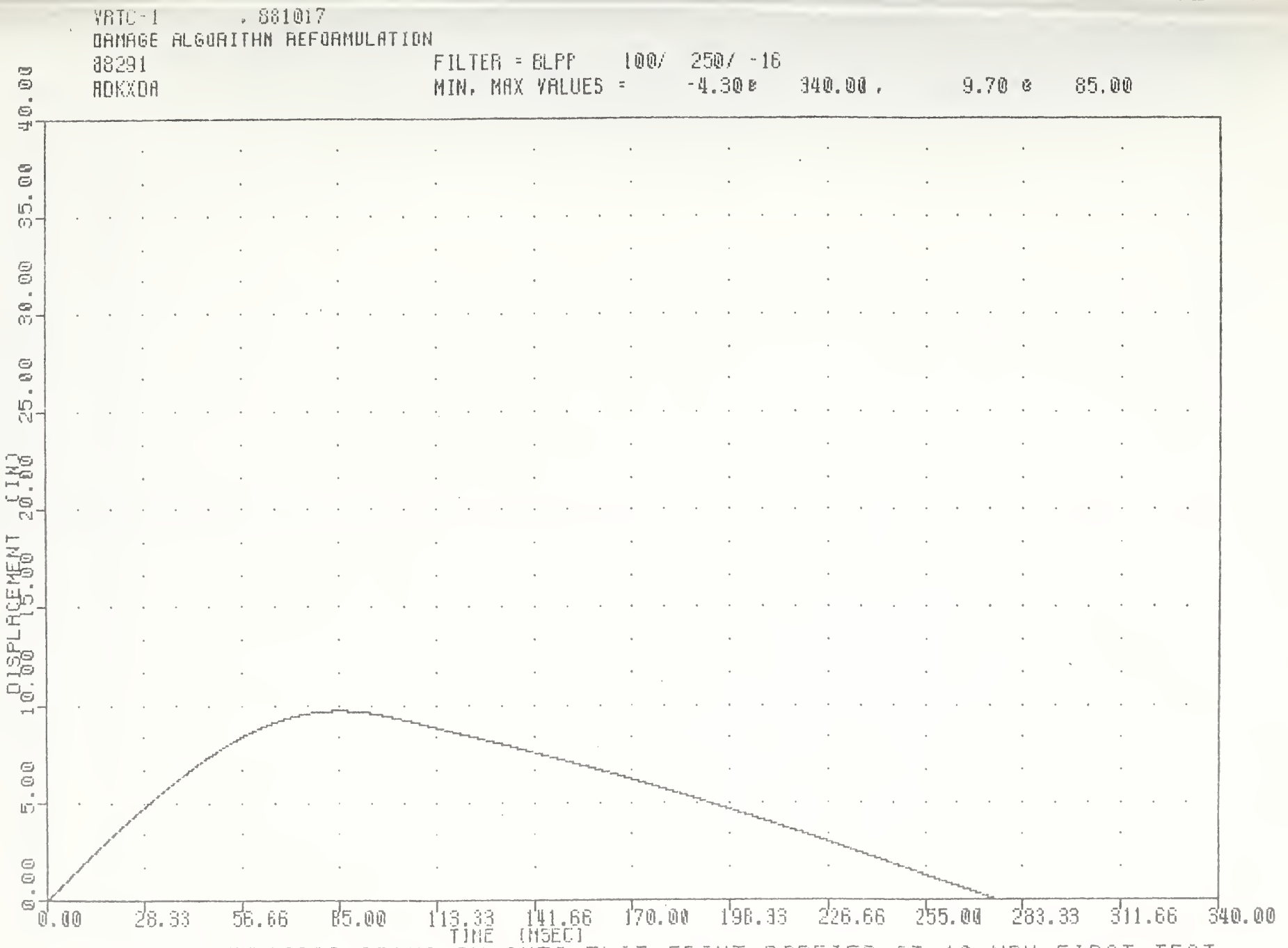
1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 10 MPH FIRST TEST
VEHICLE REAR DECK X AXIS DISPLACEMENT



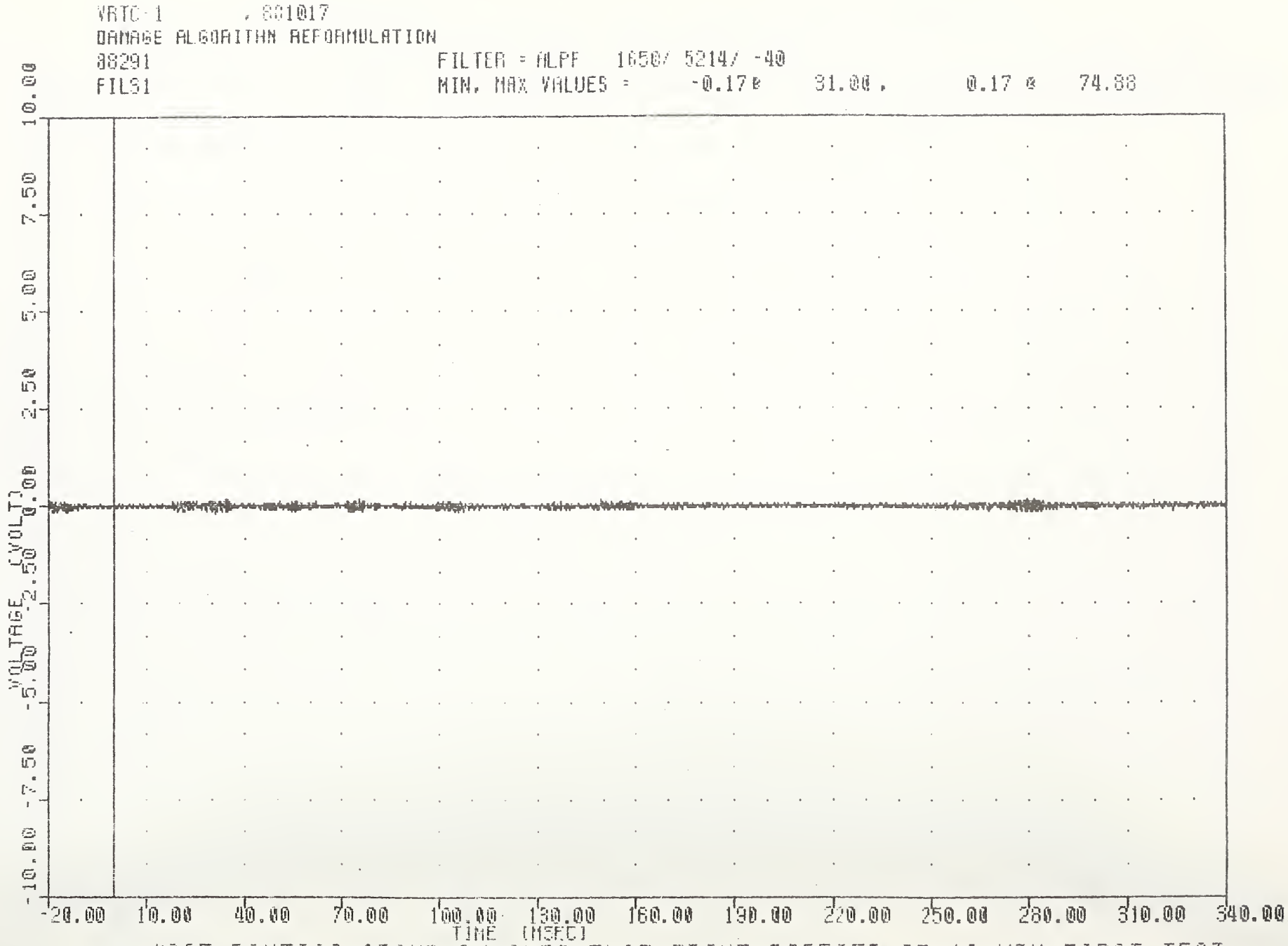
1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 10 MPH FIRST TEST
VEHICLE REAR DECK X AXIS REDUNDANT ACCELERATION



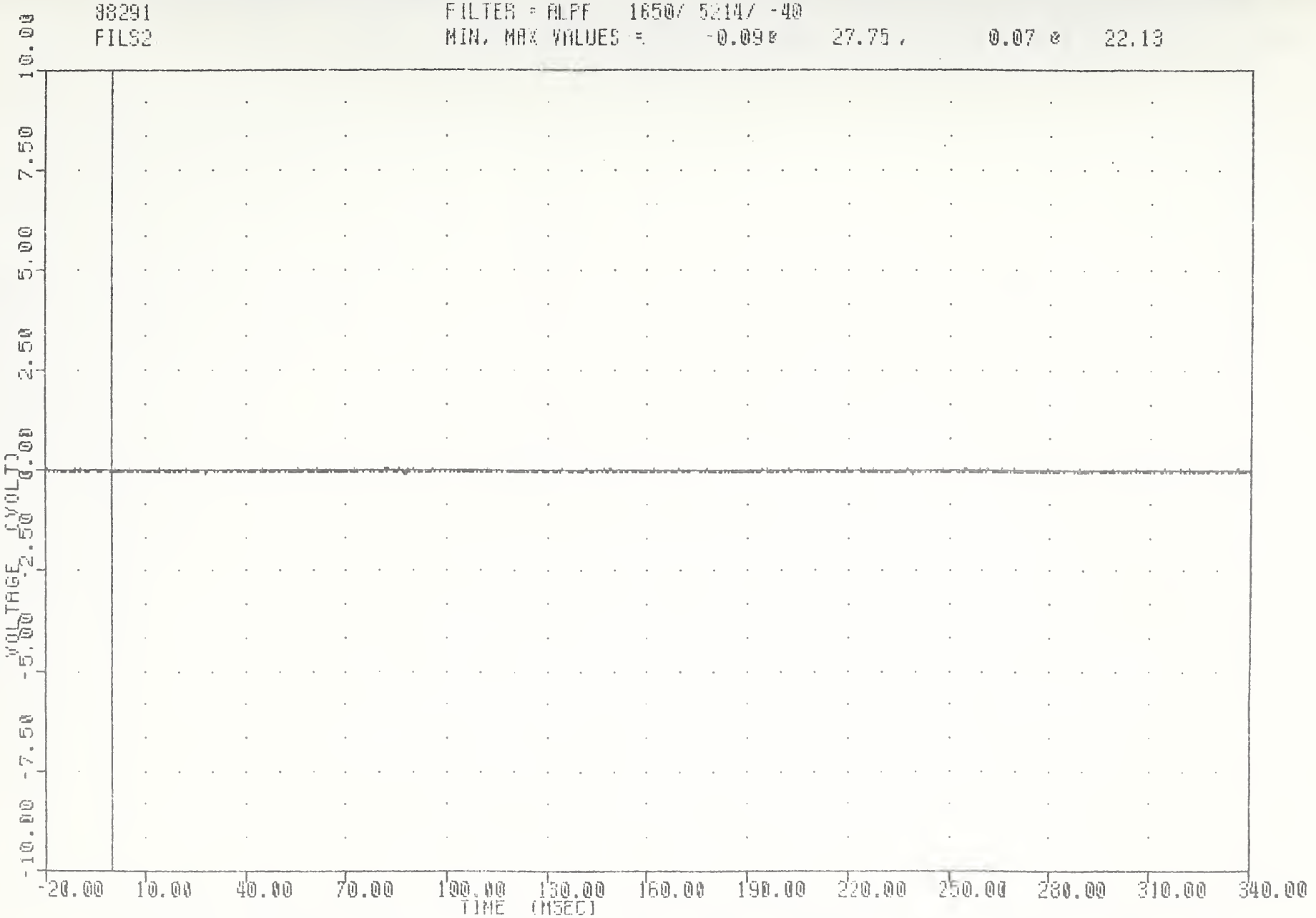
1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 10 MPH FIRST TEST
VEHICLE REAR DECK X AXIS VELOCITY REDUNDANT



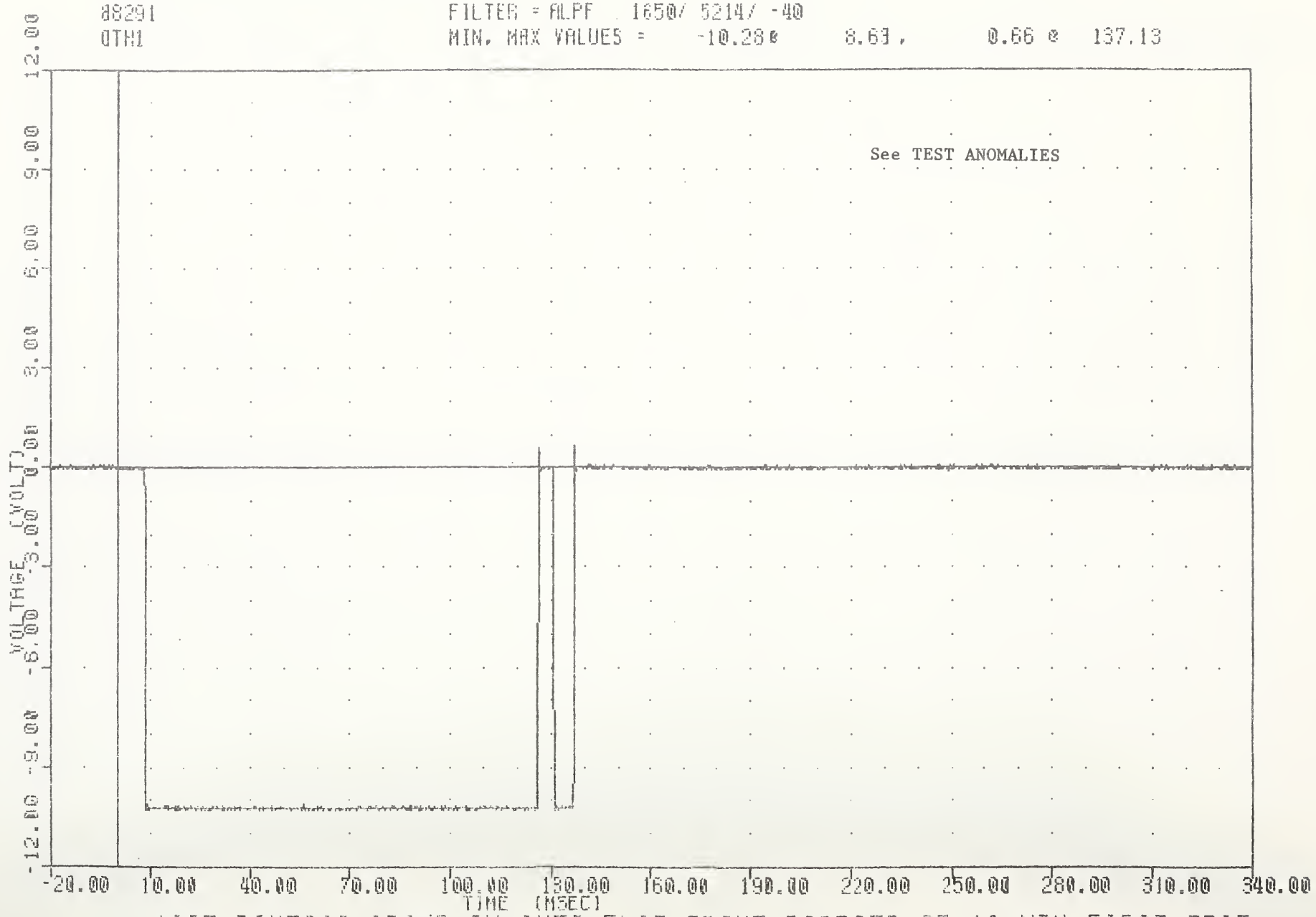
1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 10 MPH FIRST TEST
VEHICLE REAR DECK X AXIS DISPLACEMENT REDUNDANT



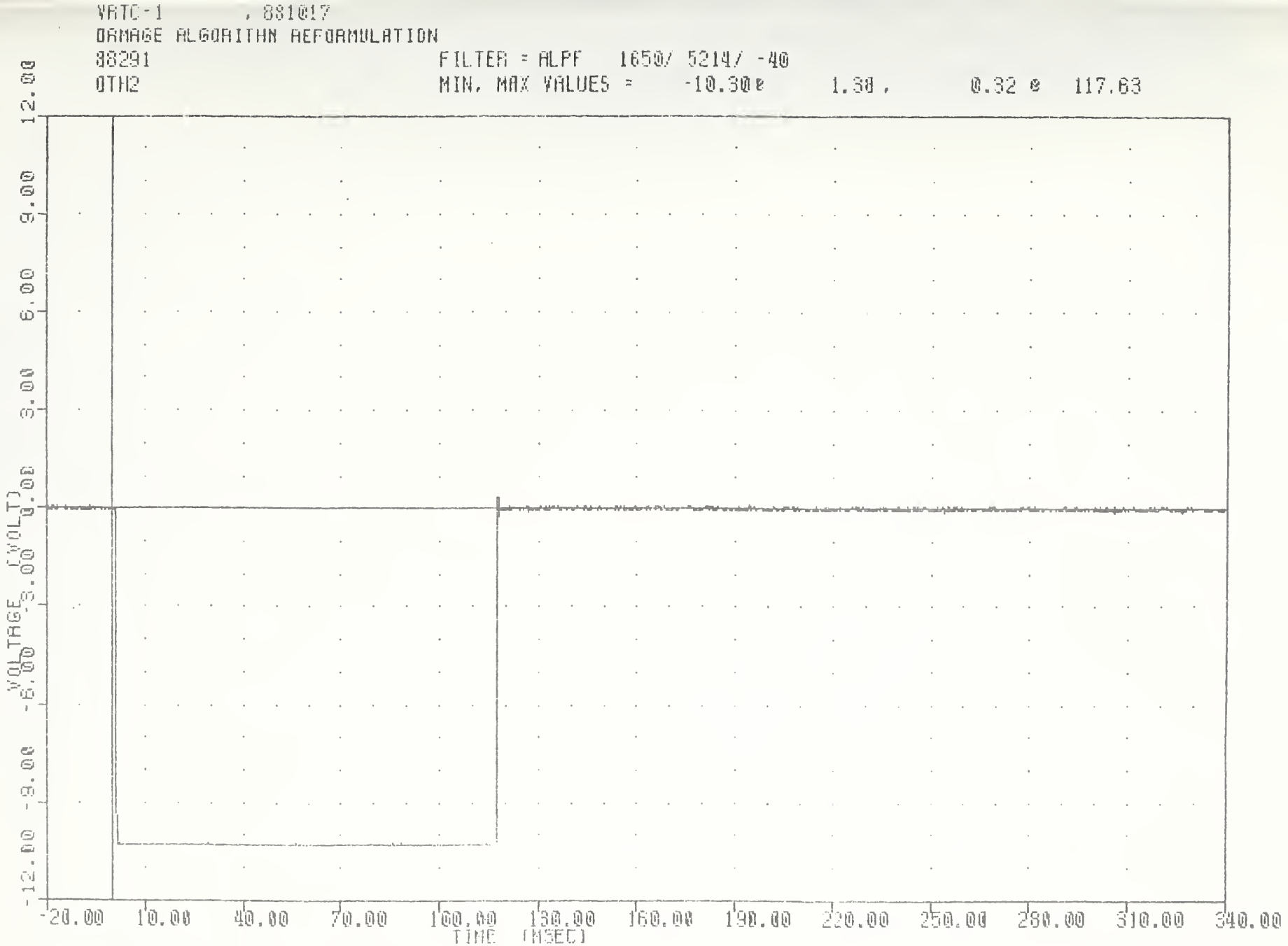
1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 10 MPH FIRST TEST
VEHICLE LEFT FENDER WELL INSIDE SENSOR #1



1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 10 MPH FIRST TEST
VEHICLE LEFT FENDER WELL INSIDE SENSOR #2

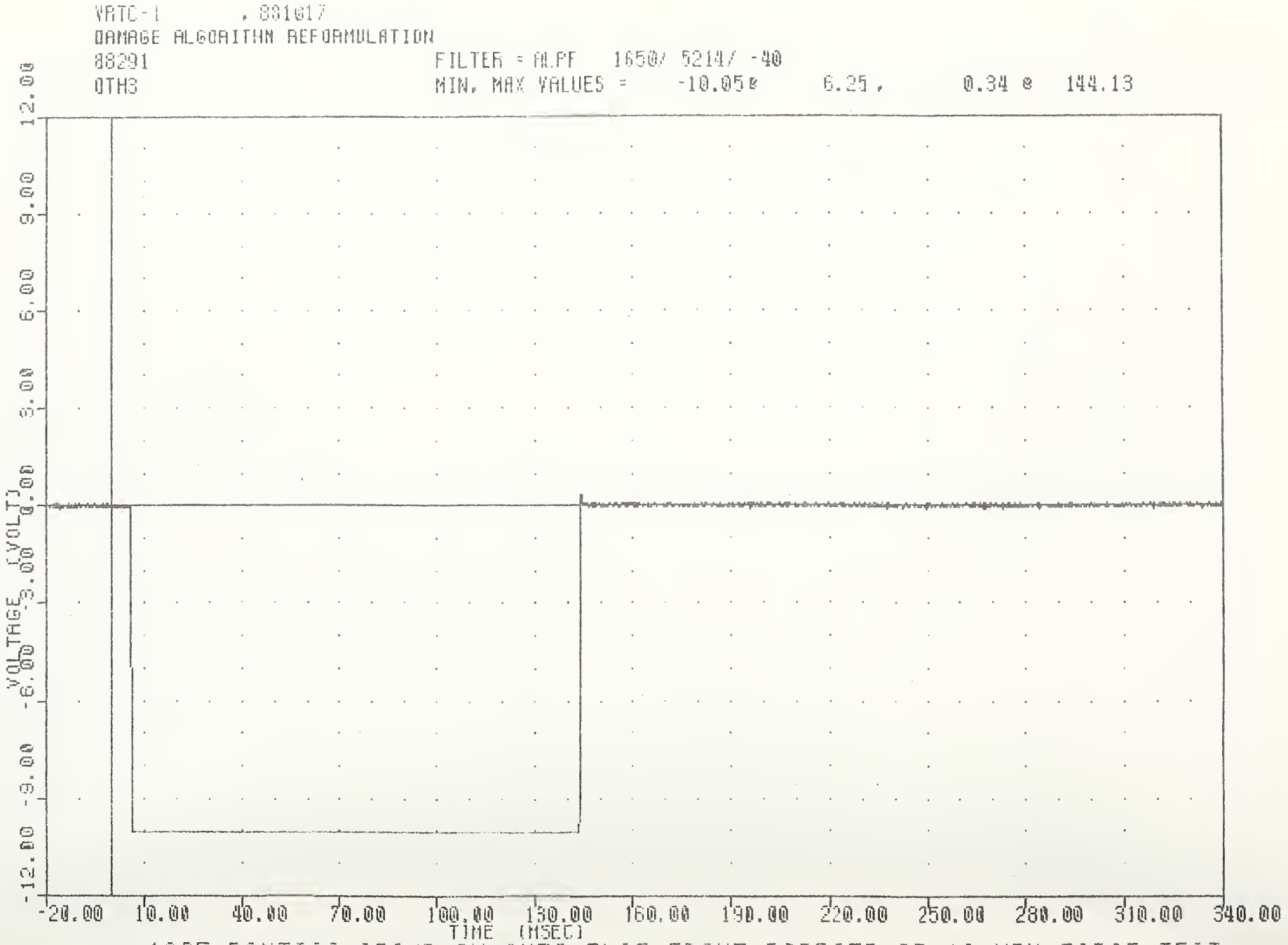


1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 10 MPH FIRST TEST
VEHICLE CONTACT SWITCH - LEFT



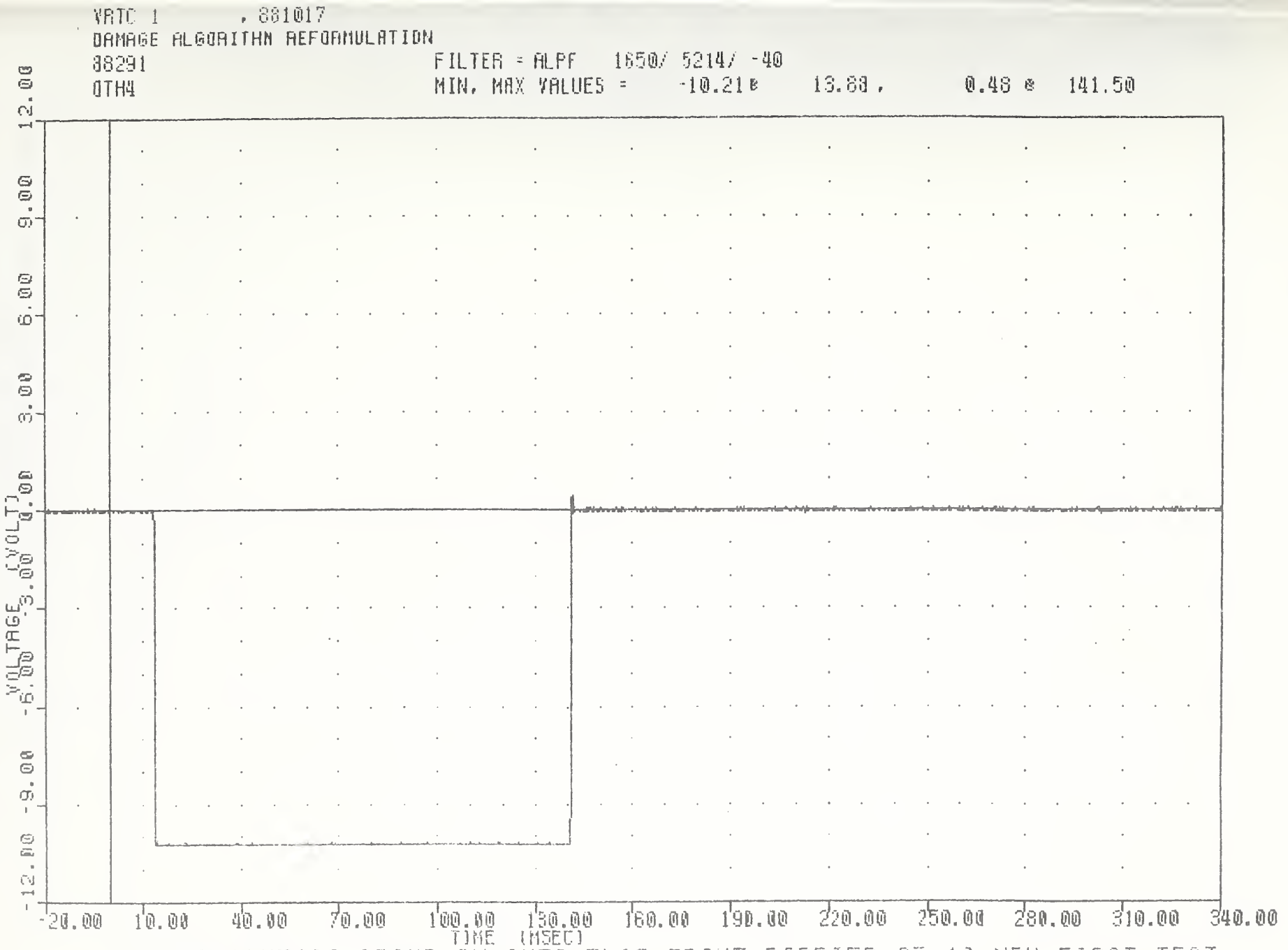
1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 10 MPH FIRST TEST

VEHICLE CONTACT SWITCH - CENTER



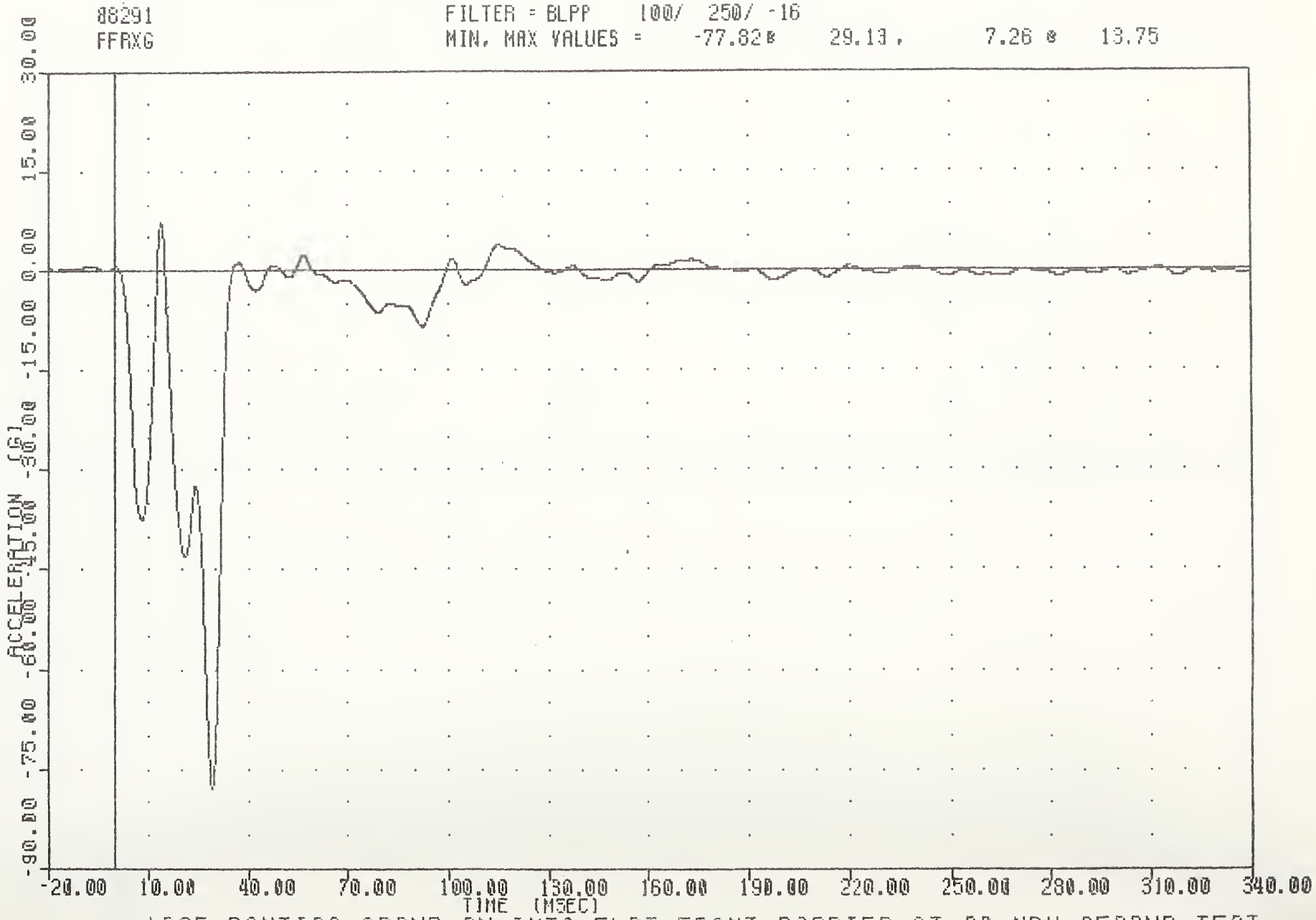
1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 10 MPH FIRST TEST

VEHICLE CONTACT SWITCH - RIGHT

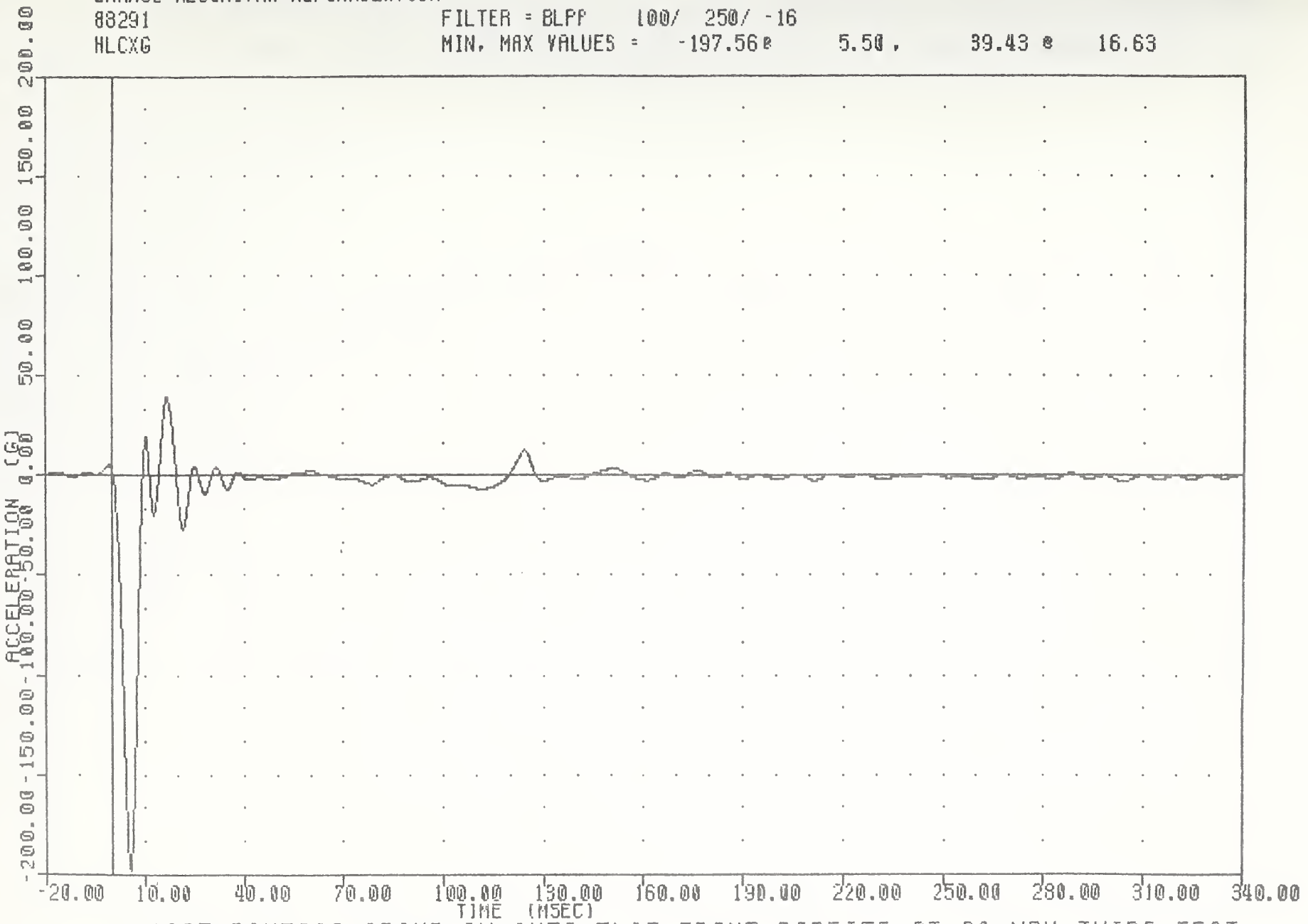


1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 10 MPH FIRST TEST

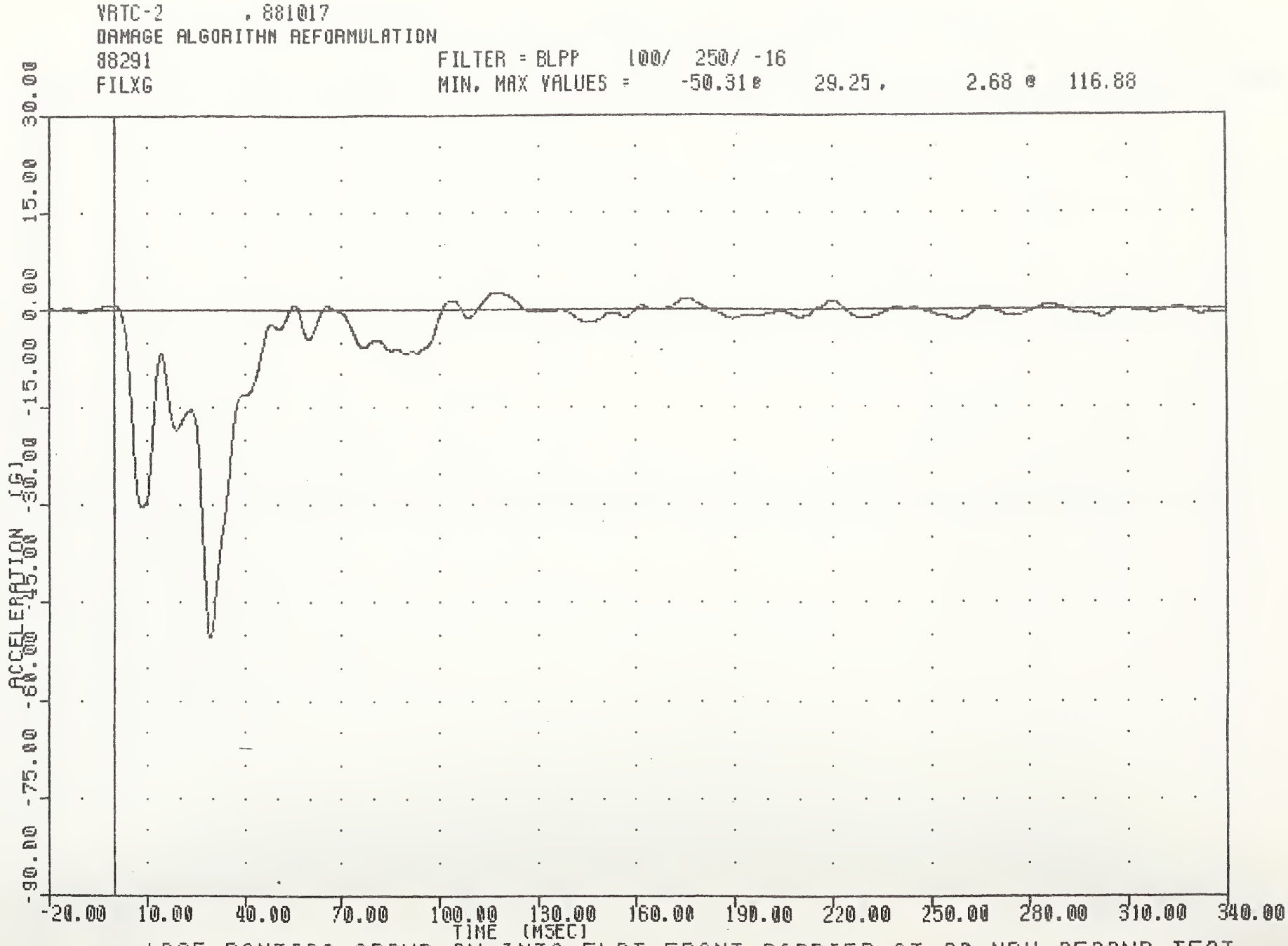
BARRIER CONTACT SWITCH - LEFT



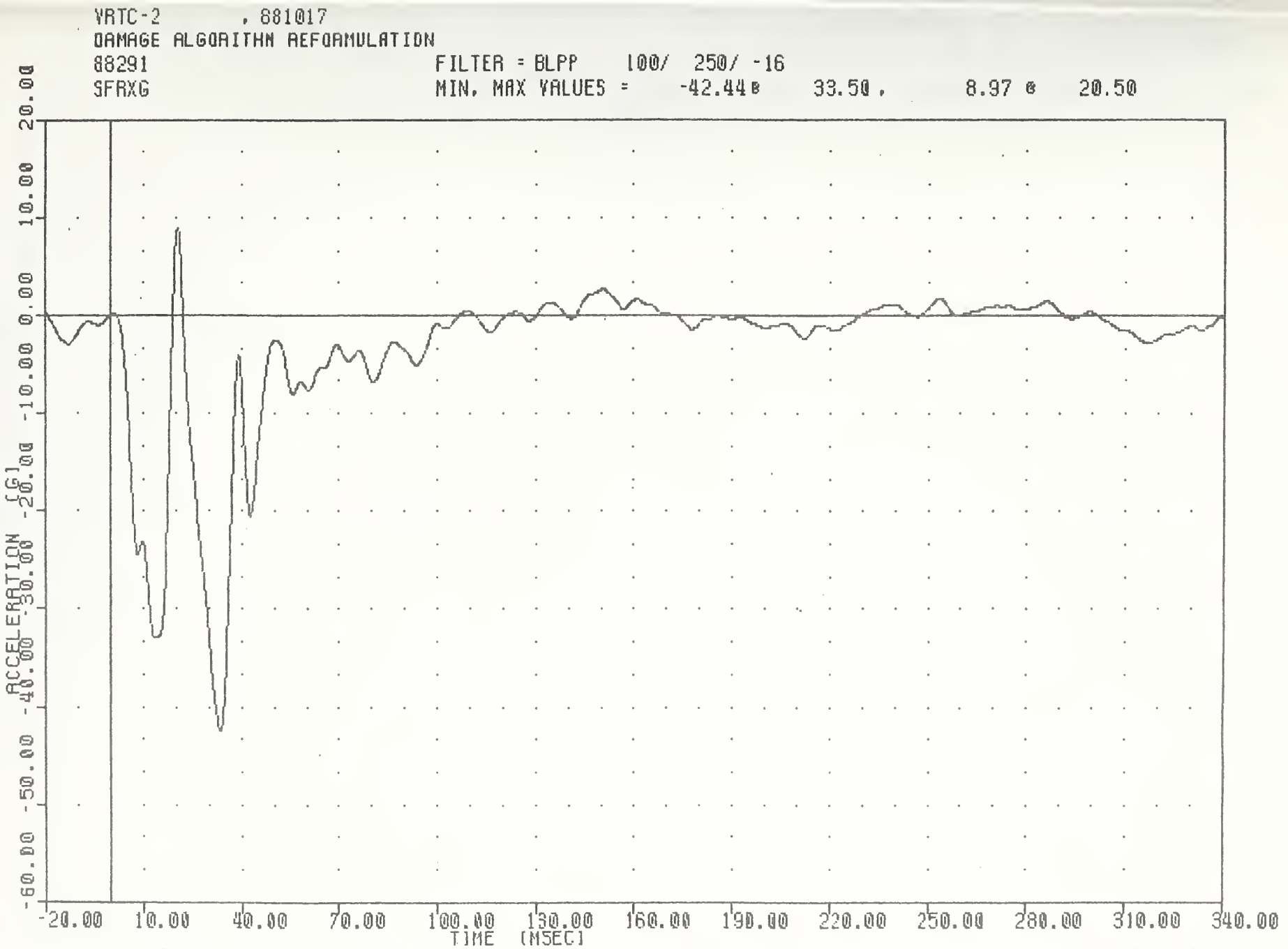
1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 20 MPH SECOND TEST
VEHICLE LEFT FRAME RAIL FRONT X AXIS ACCELERATION



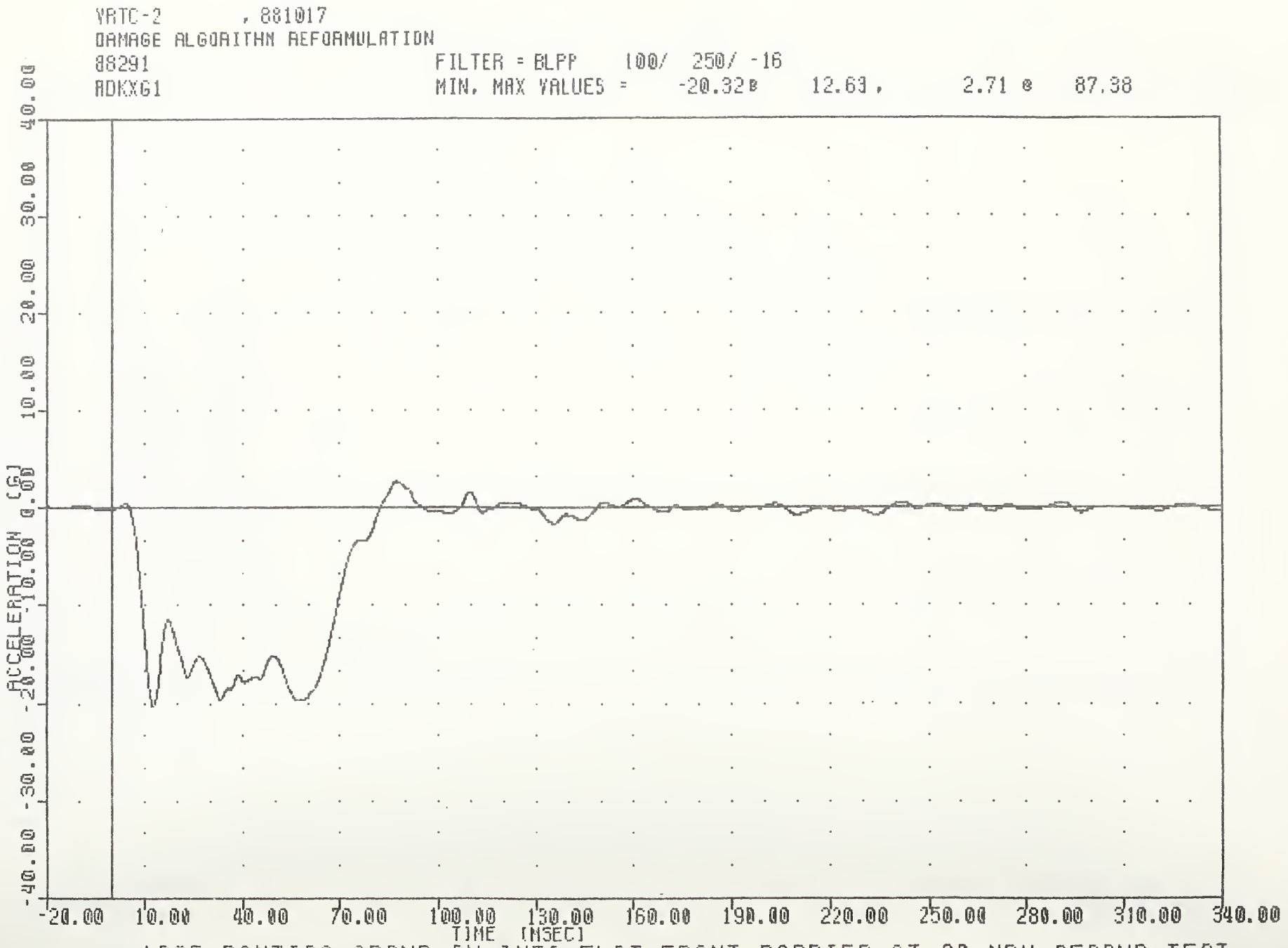
1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 20 MPH THIRD TEST
VEHICLE HOOD LATCH CROSSMEMBER X AXIS ACCELERATION



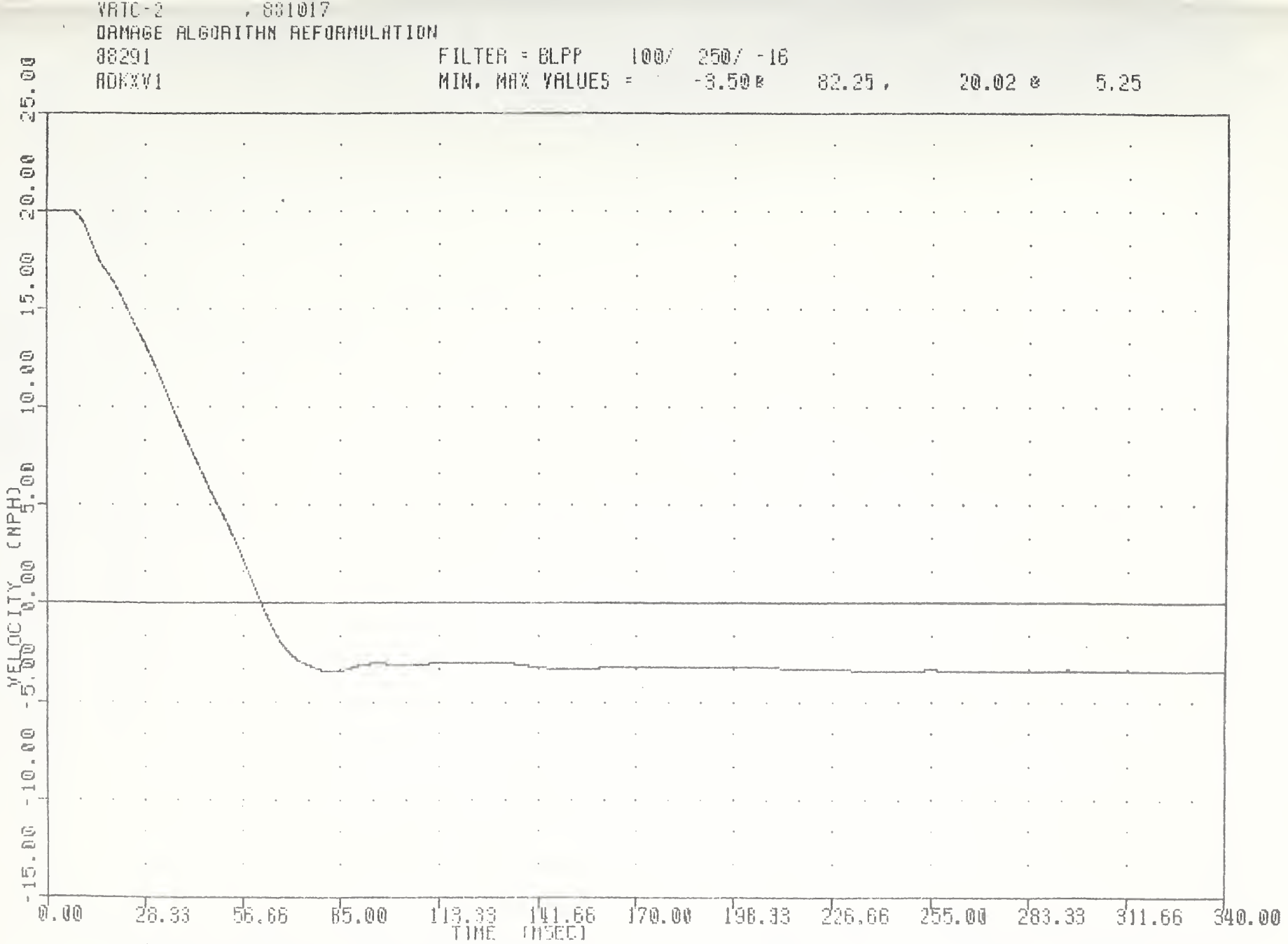
1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 20 MPH SECOND TEST
VEHICLE LEFT FENDER WELL INSIDE X AXIS ACCELERATION



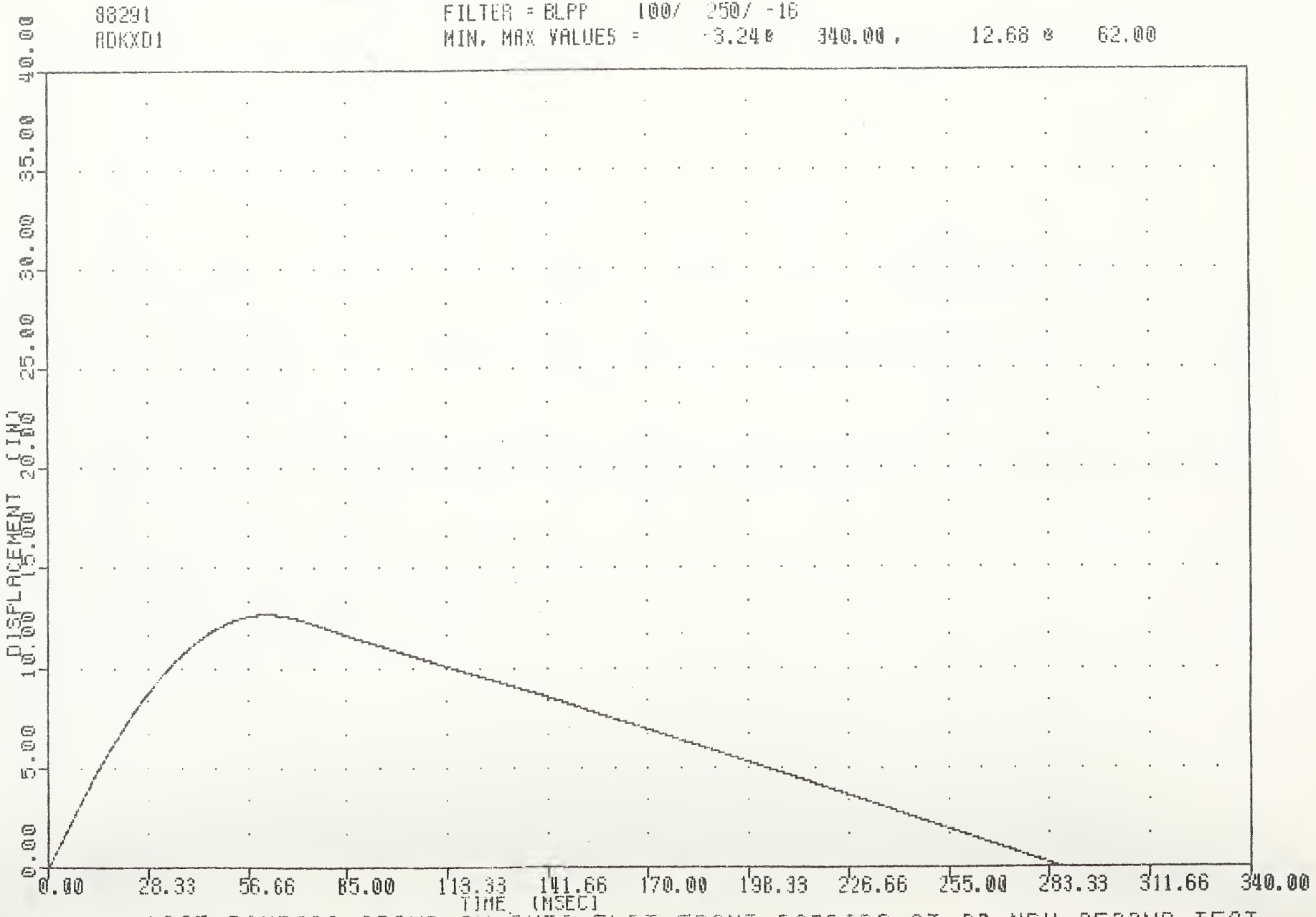
1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 20 MPH SECOND TEST
VEHICLE SUSPENSION FRONT RIGHT X AXIS ACCELERATION



1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 20 MPH SECOND TEST
VEHICLE REAR DECK X AXIS ACCELERATION

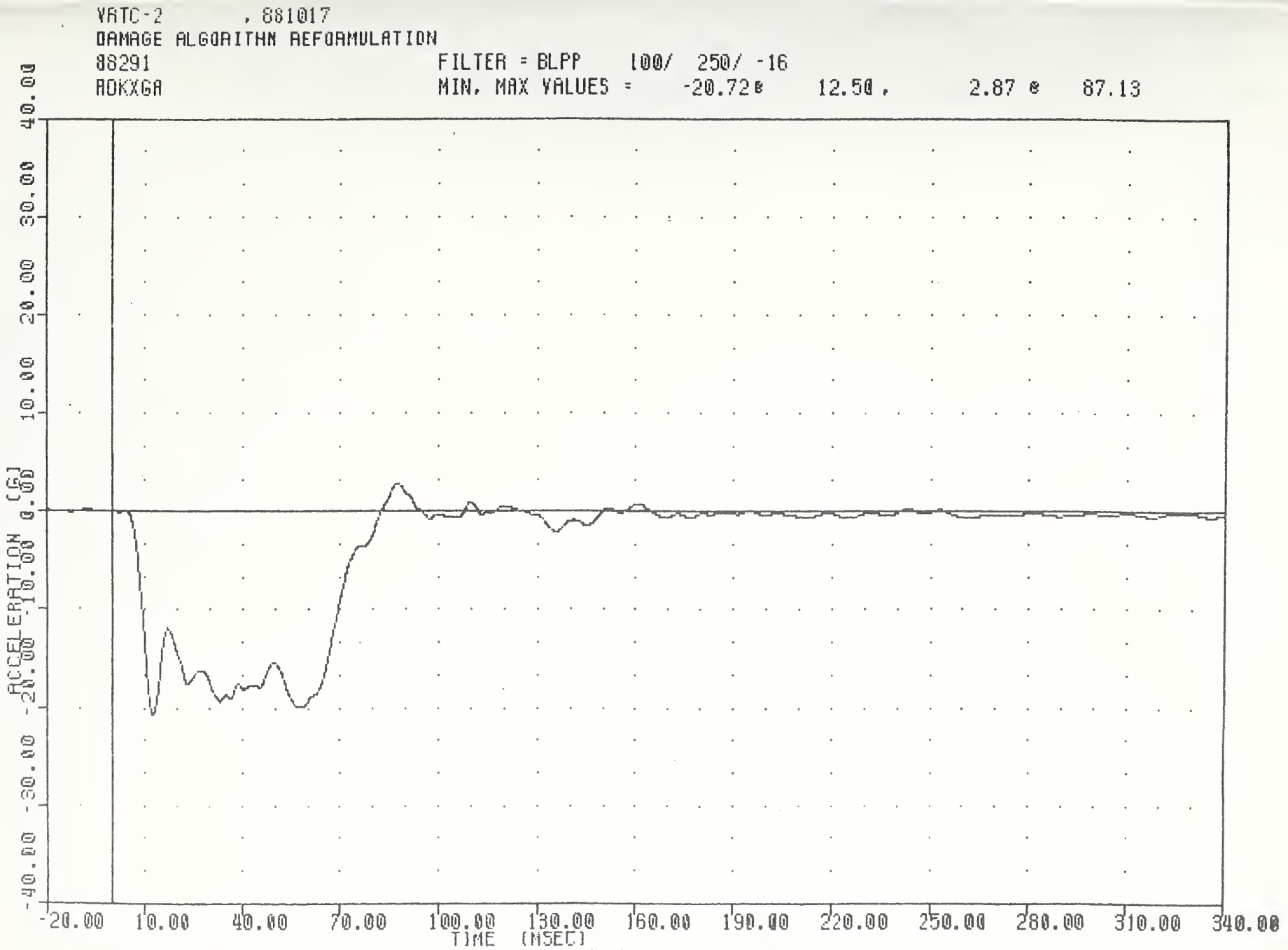


1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 20 MPH SECOND TEST
VEHICLE REAR DECK X AXIS VELOCITY

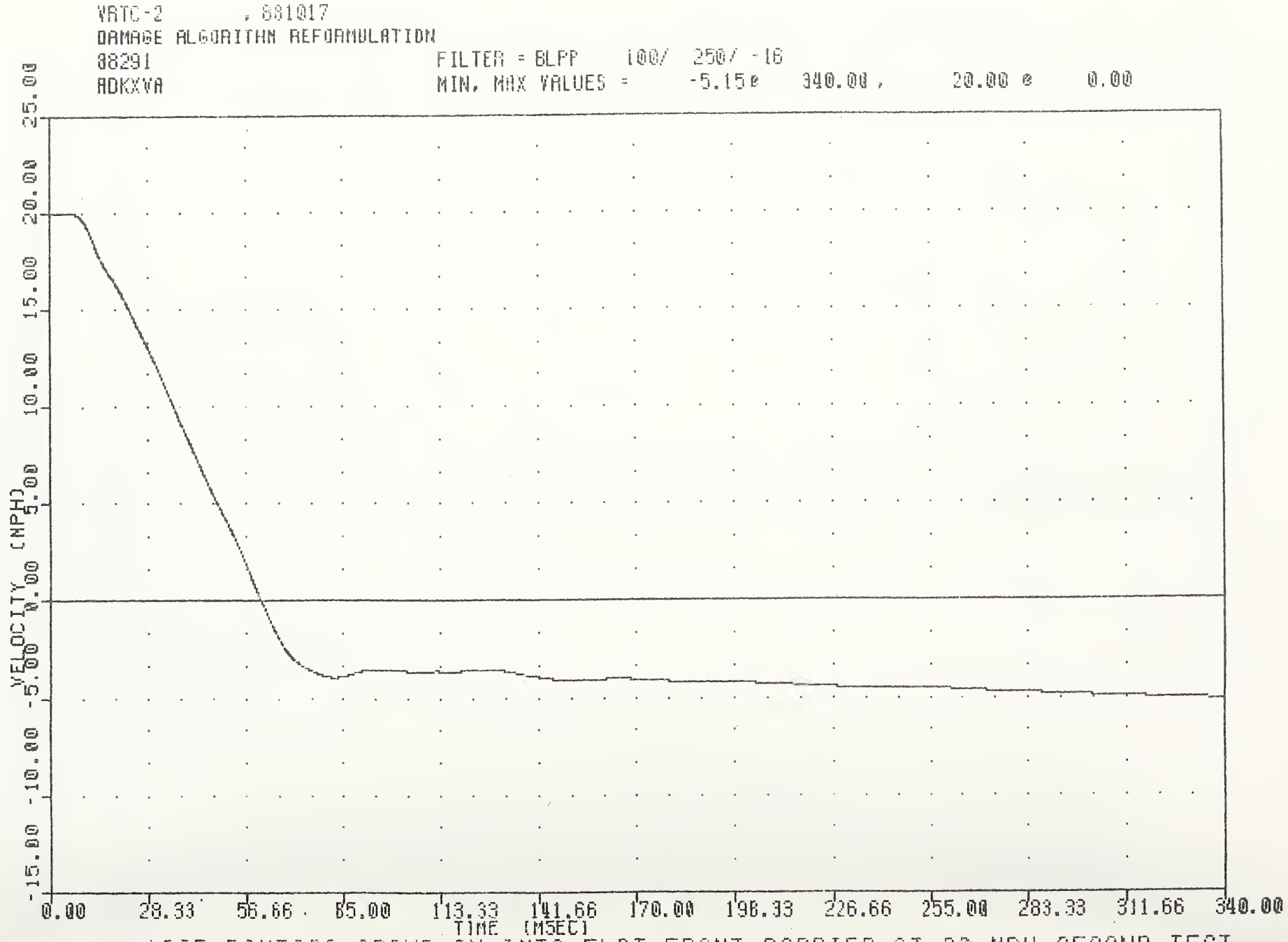


1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 20 MPH SECOND TEST

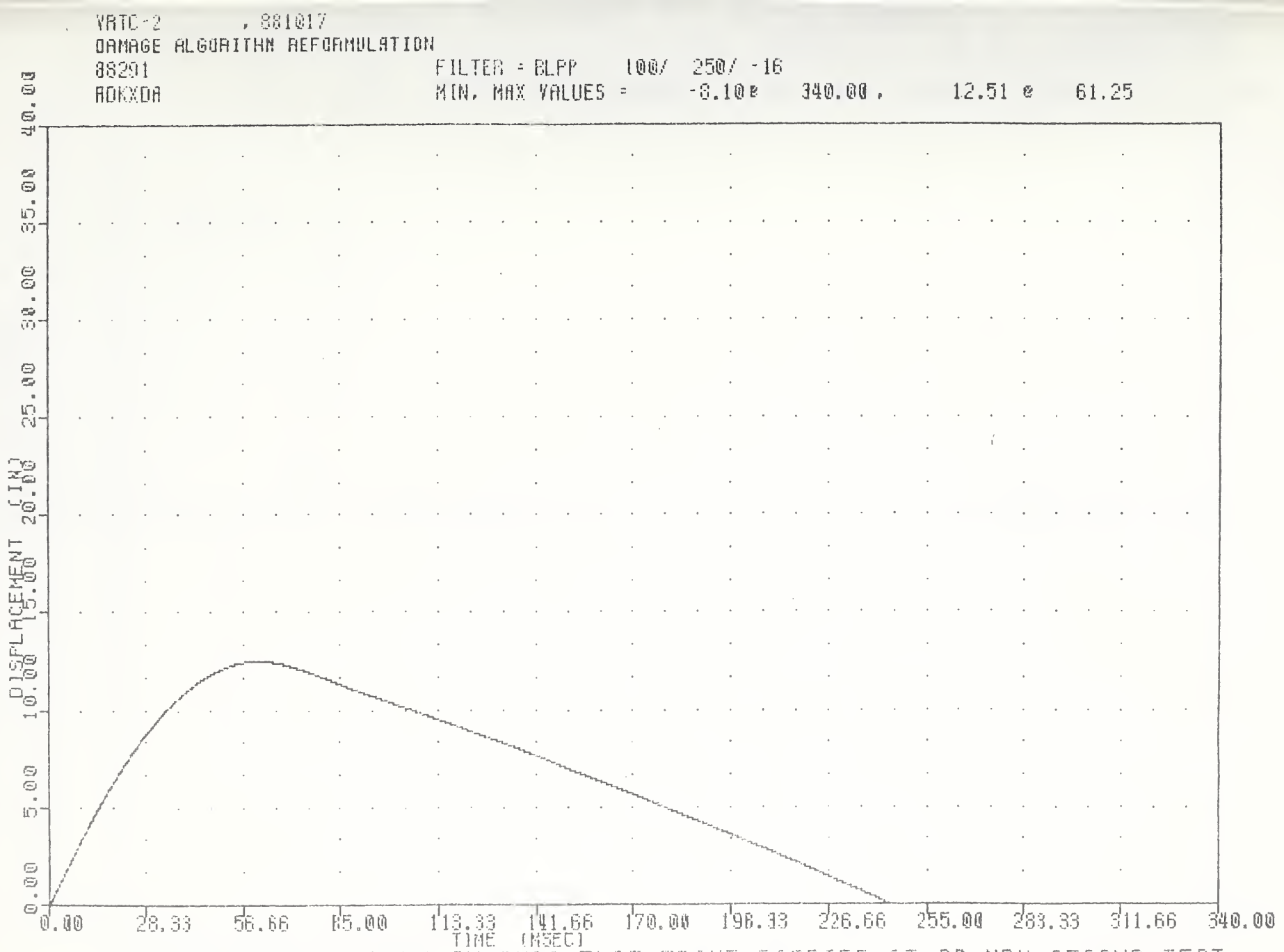
VEHICLE REAR DECK X AXIS DISPLACEMENT



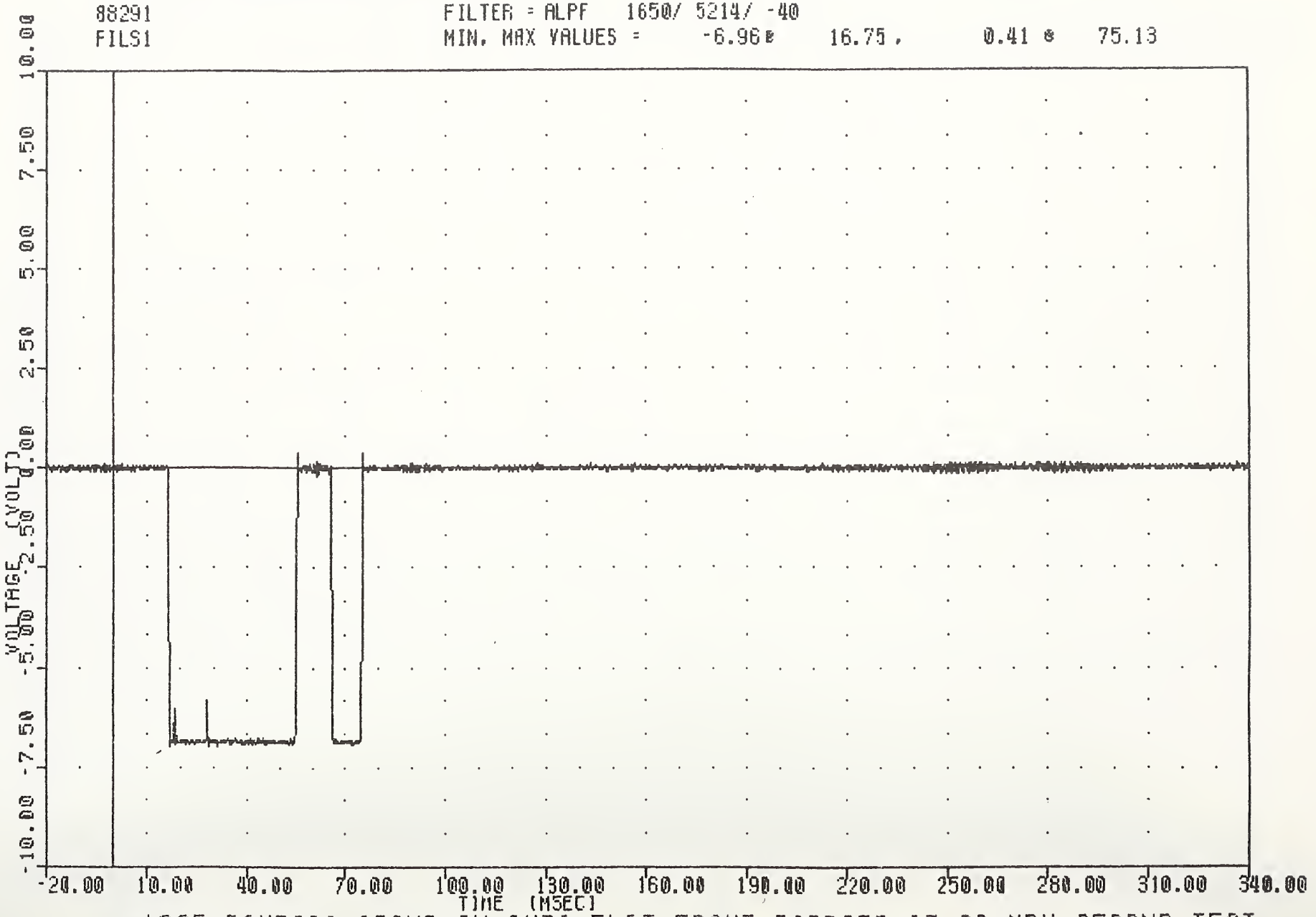
1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 20 MPH SECOND TEST
VEHICLE REAR DECK X AXIS REDUNDANT ACCELERATION



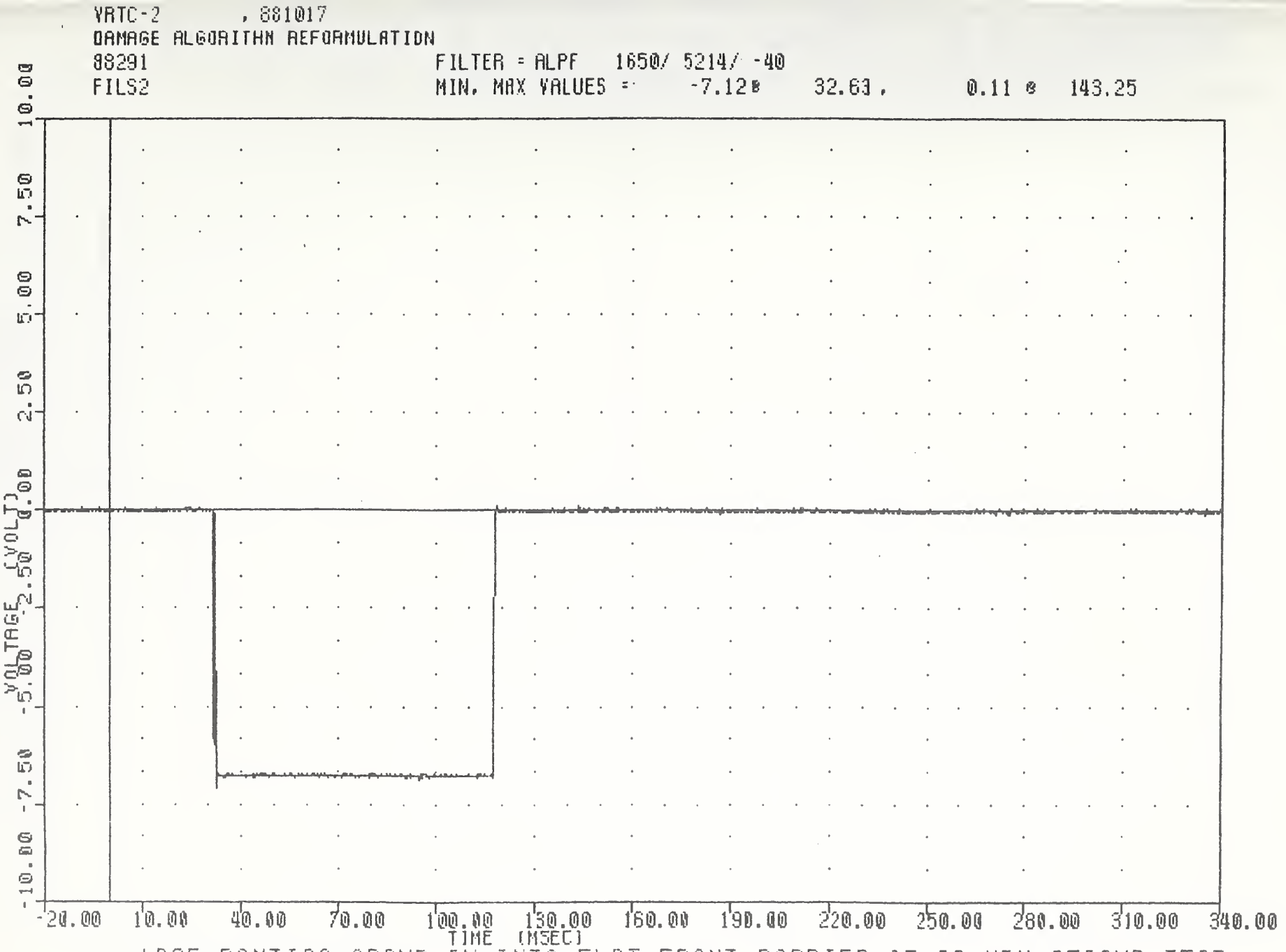
1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 20 MPH SECOND TEST
VEHICLE REAR DECK X AXIS VELOCITY REDUNDANT



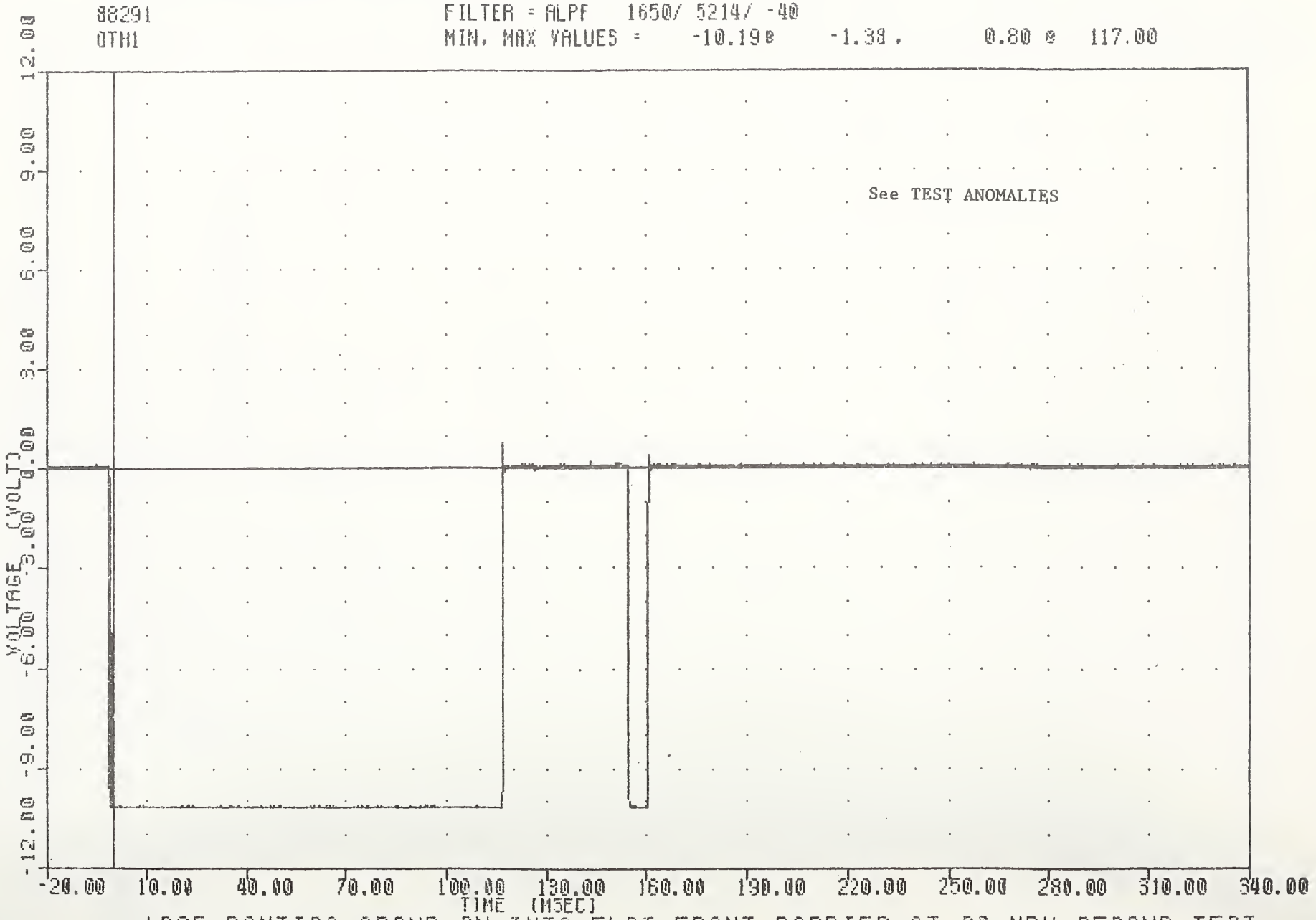
1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 20 MPH SECOND TEST
VEHICLE REAR DECK X AXIS DISPLACEMENT REDUNDANT



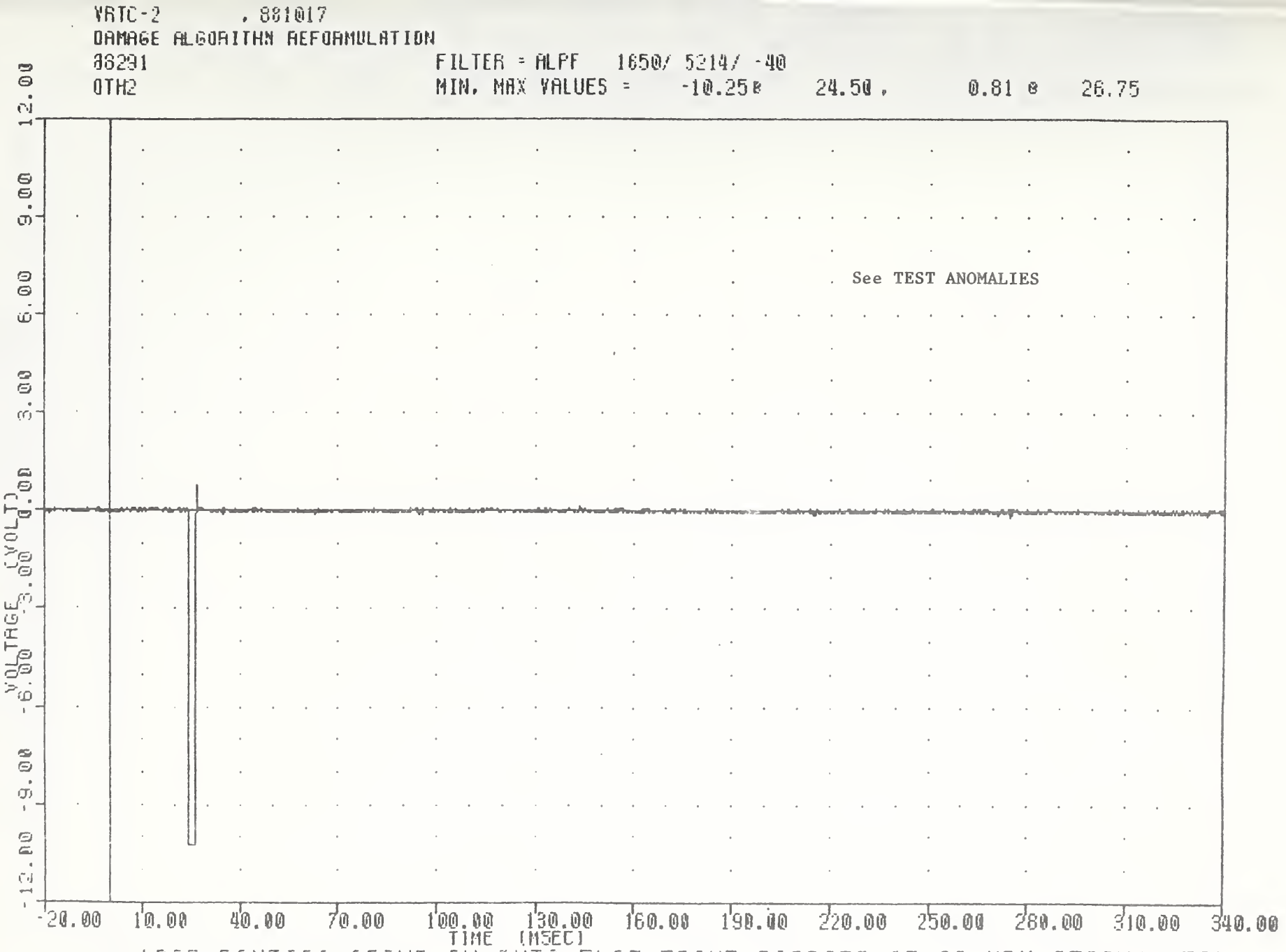
1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 20 MPH SECOND TEST
VEHICLE LEFT FENDER WELL INSIDE SENSOR #1



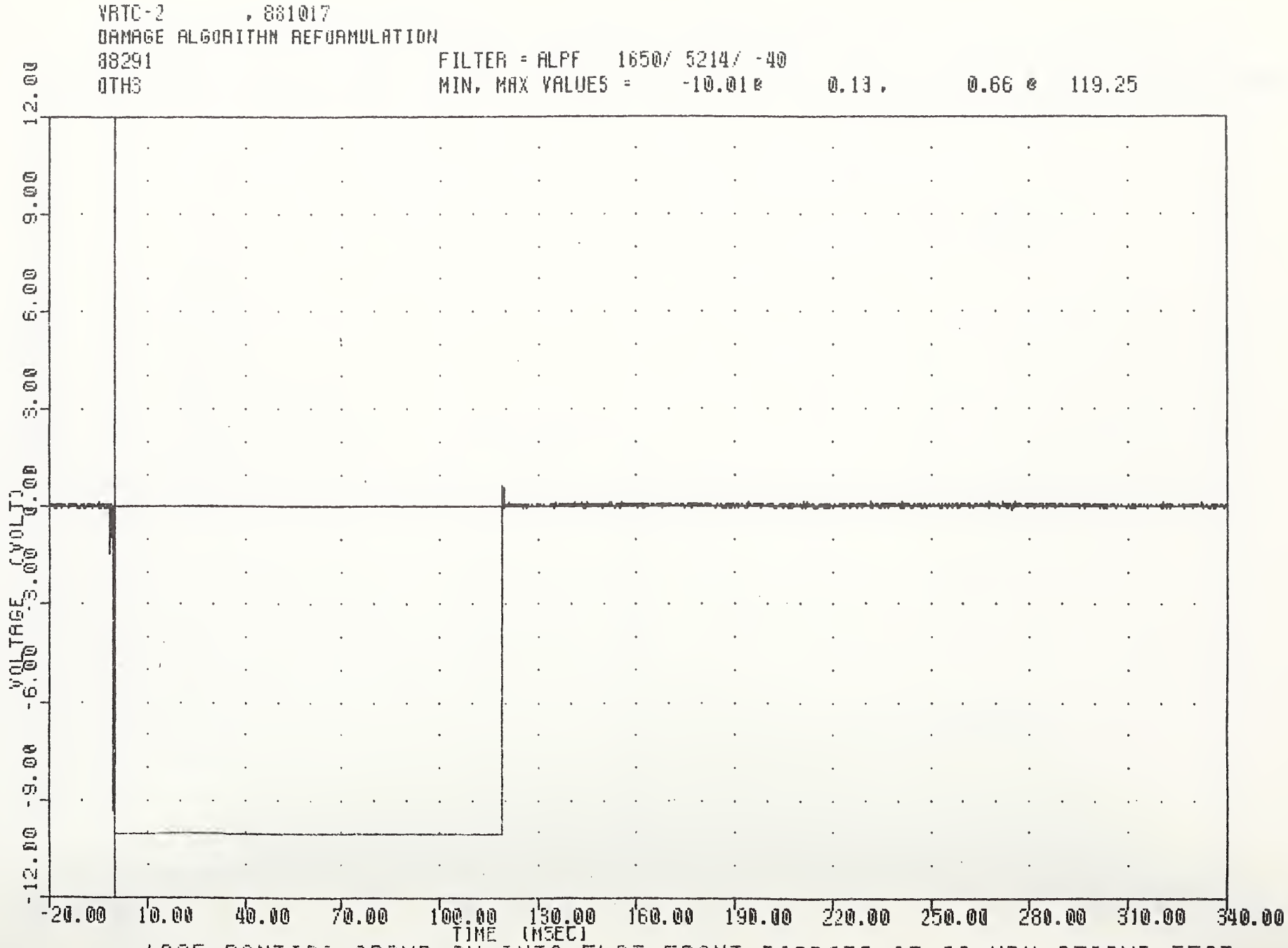
1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 20 MPH SECOND TEST
VEHICLE LEFT FENDER WELL INSIDE SENSOR #2



1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 20 MPH SECOND TEST
VEHICLE CONTACT SWITCH - LEFT



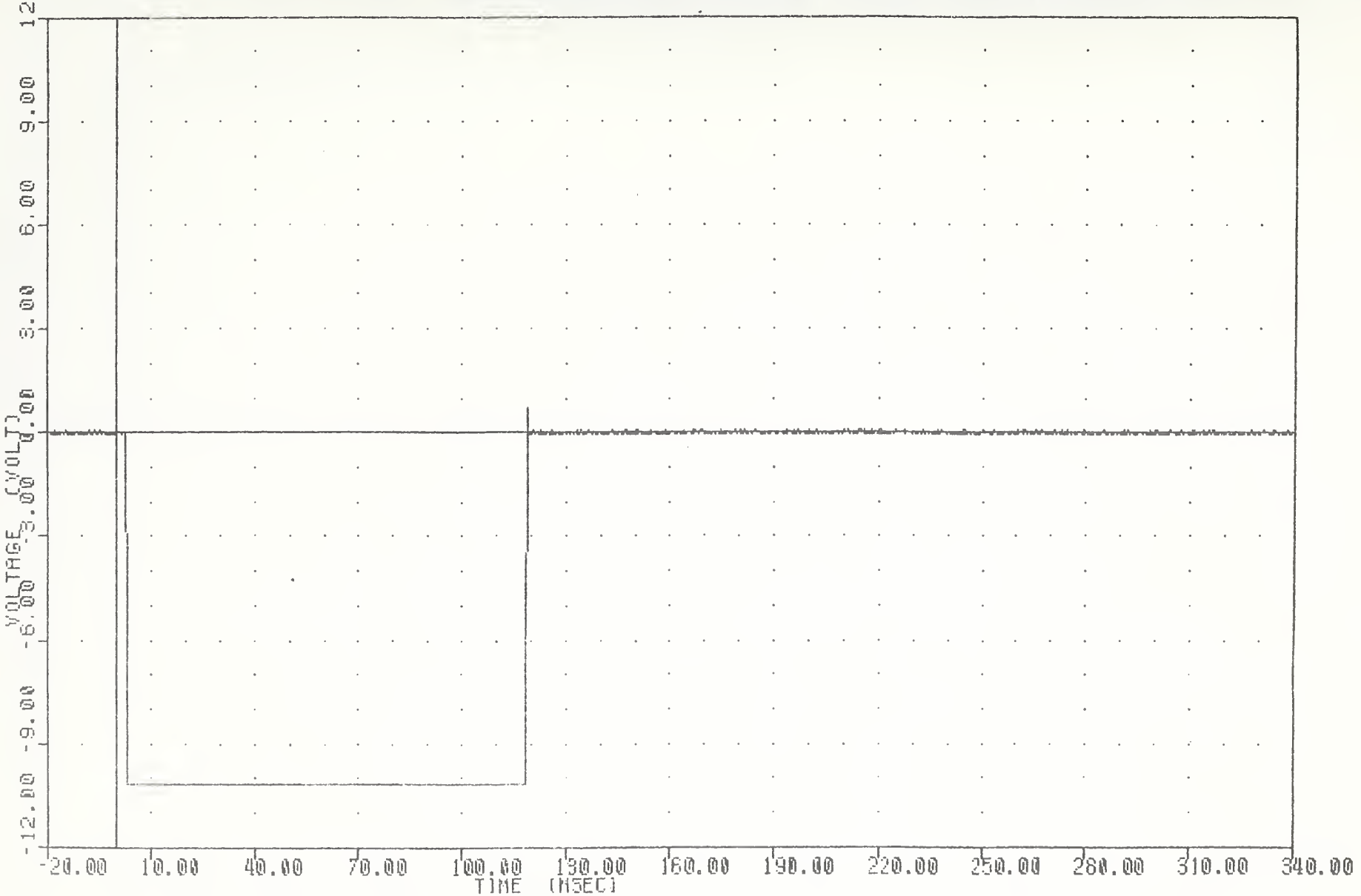
1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 20 MPH SECOND TEST
VEHICLE CONTACT SWITCH - CENTER



1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 20 MPH SECOND TEST

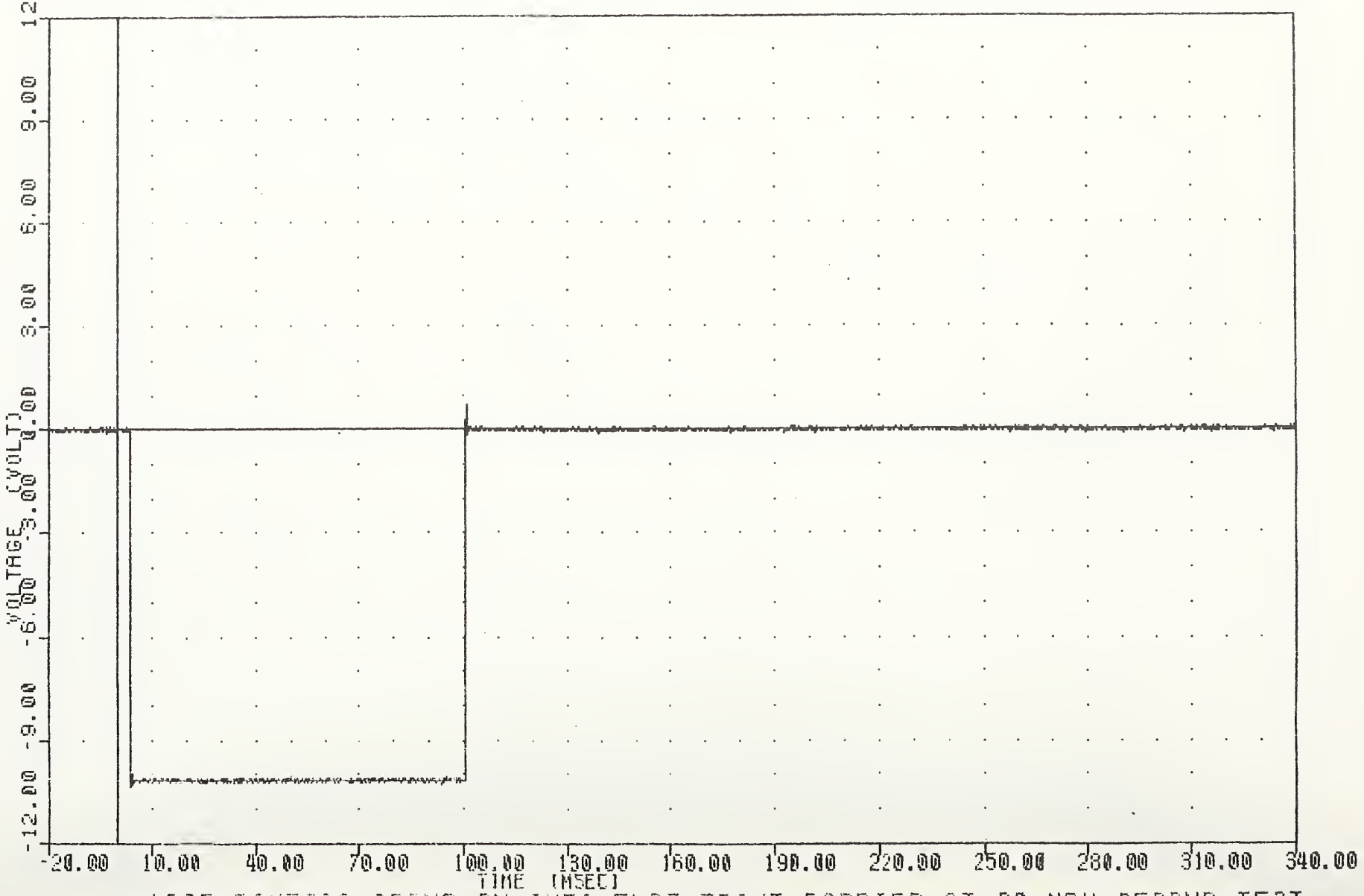
VEHICLE CONTACT SWITCH - RIGHT

VRTC-2 , 881017
DAMAGE ALGORITHM REFORMULATION
88291 FILTER = ALPF 1650/ 5214/ -40
OTH4 MIN, MAX VALUES = -10.16 @ 3.13 , 0.74 @ 118.88

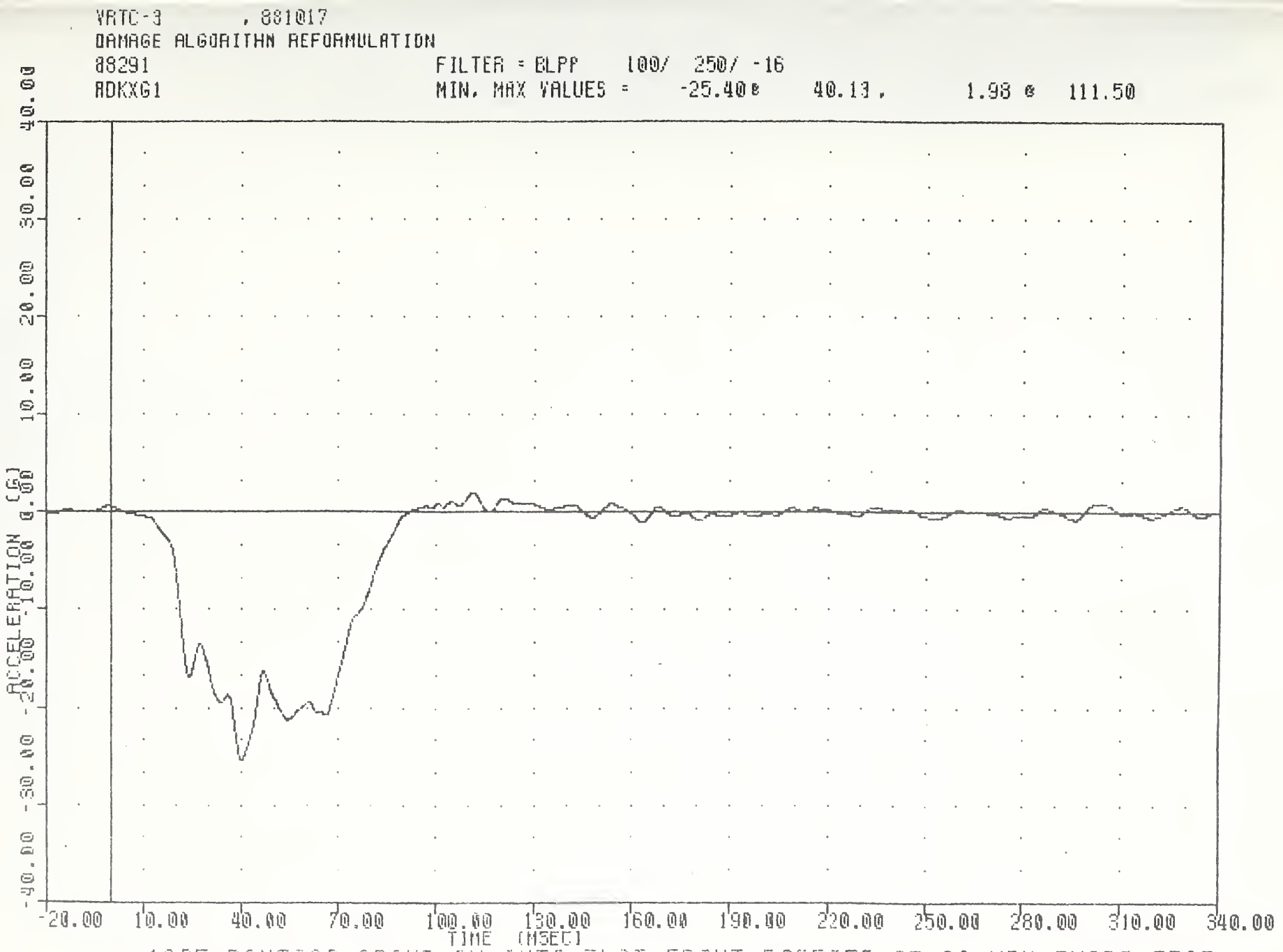


1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 20 MPH SECOND TEST
BARRIER CONTACT SWITCH LEFT

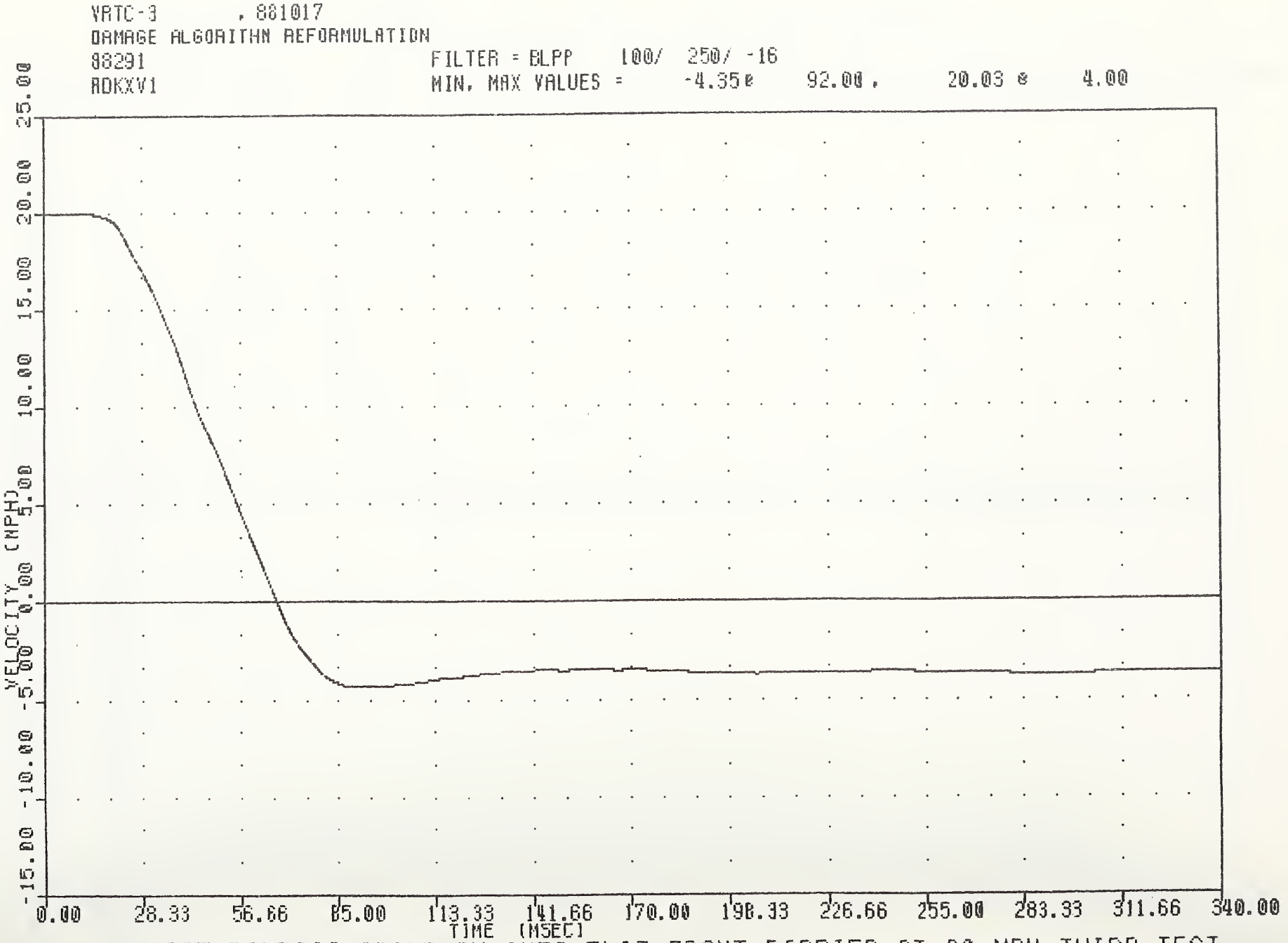
VRTC-2 , 881017
DAMAGE ALGORITHN REFORMULATION
88291 FILTER = ALPF 1650/ 5214/ -40
0TH5 MIN, MAX VALUES = -10.36 @ 3.88 , 0.73 @ 100.75



1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 20 MPH SECOND TEST
BARRIER CONTACT SWITCH - RIGHT

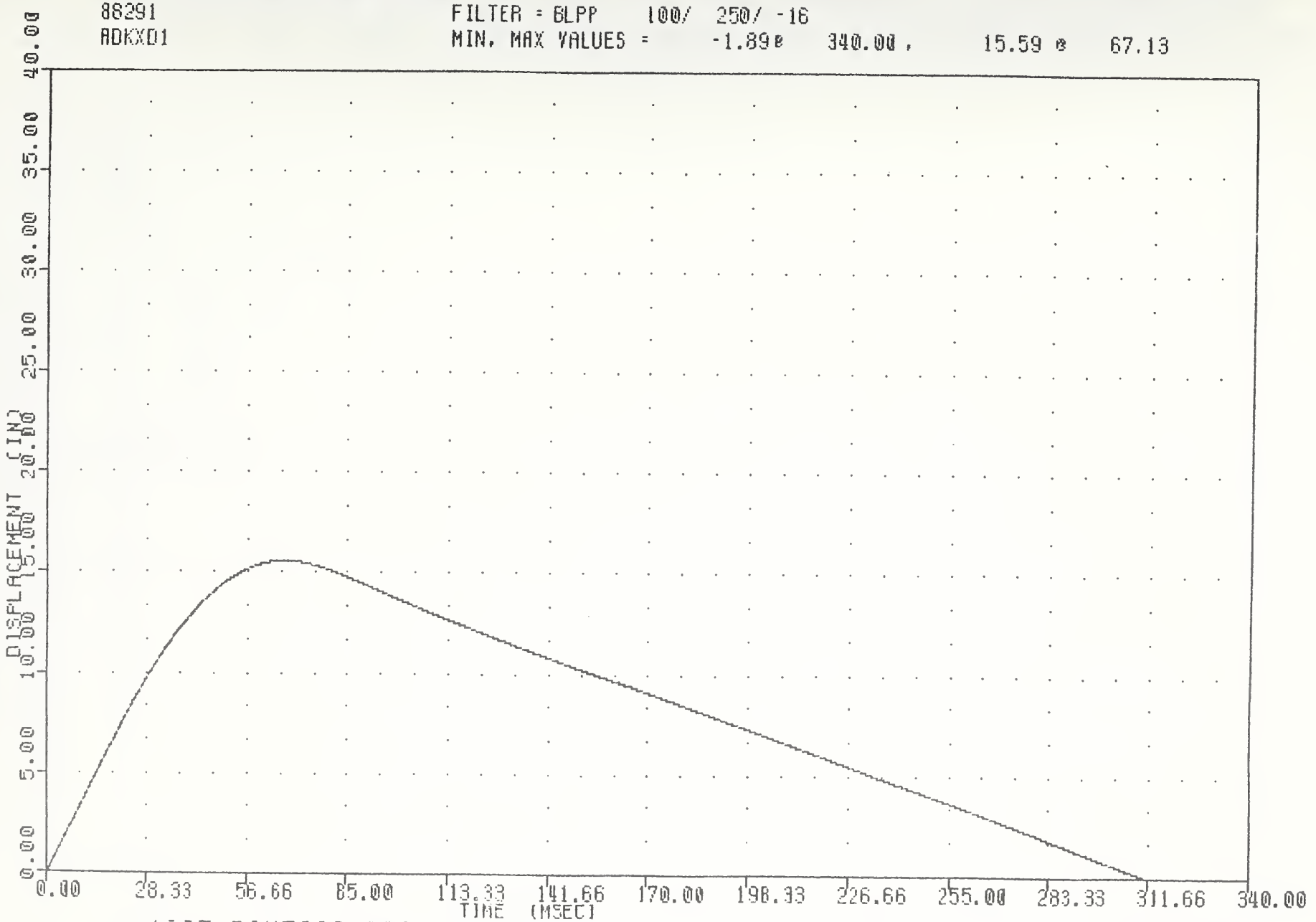


1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 20 MPH THIRD TEST
VEHICLE REAR DECK X AXIS ACCELERATION

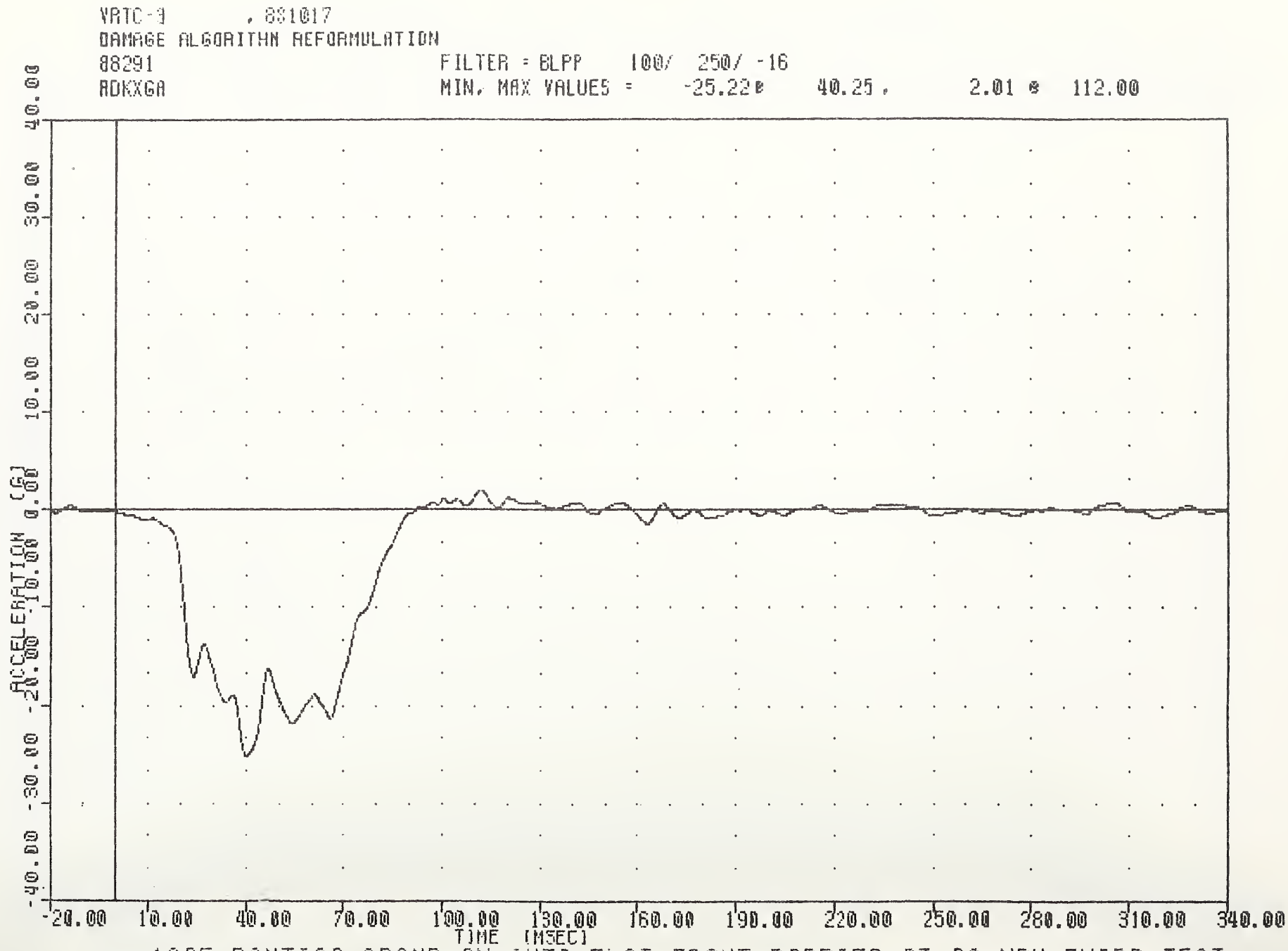


1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 20 MPH THIRD TEST
VEHICLE REAR DECK X AXIS VELOCITY

VRTC-9 , 881017
DAMAGE ALGORITHN REFORMULATION
88291 FILTER = BLPP 100/ 250/ -16
RDKXD1 MIN, MAX VALUES = -1.89 @ 340.00 , 15.59 @ 67.13

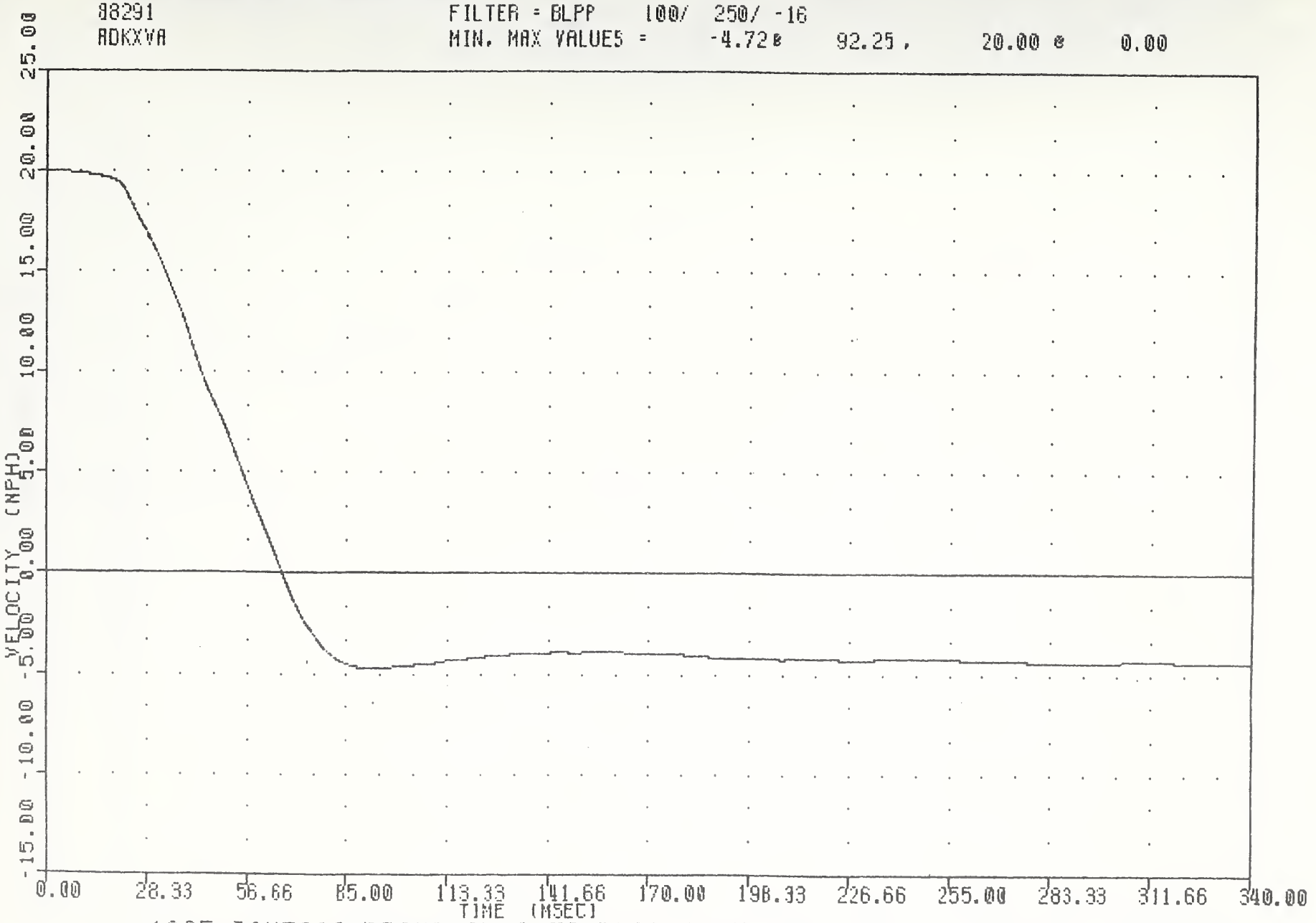


1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 20 MPH THIRD TEST
VEHICLE REAR DECK X AXIS DISPLACEMENT

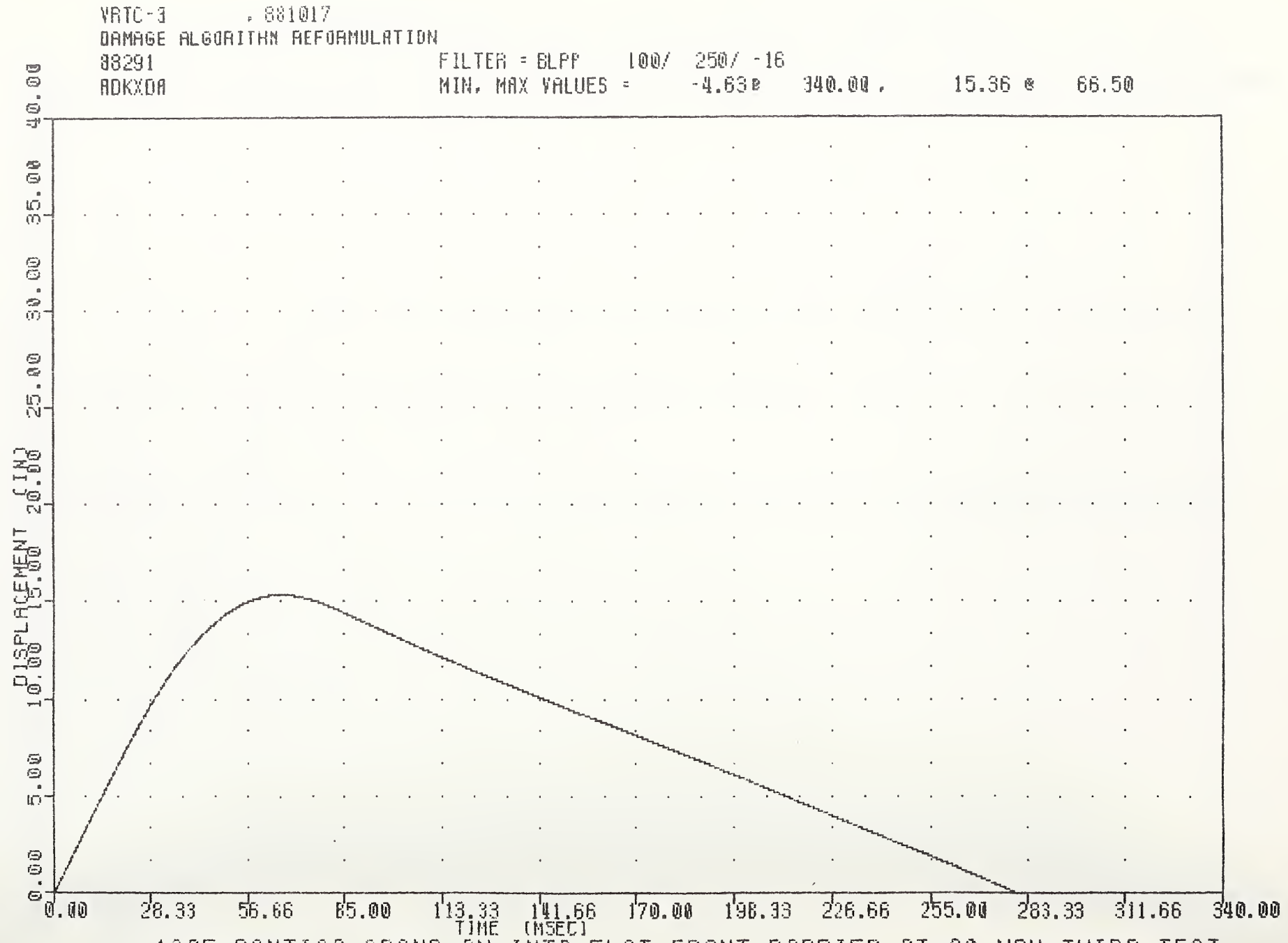


1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 20 MPH THIRD TEST
VEHICLE REAR DECK X AXIS REDUNDANT ACCELERATION

VRTC-3 , 881017
DAMAGE ALGORITHM REFORMULATION
88291 FILTER = BLPP 100/ 250/ -16
RDKXVR MIN. MAX VALUES = -4.72 @ 92.25 , 20.00 @ 0.00

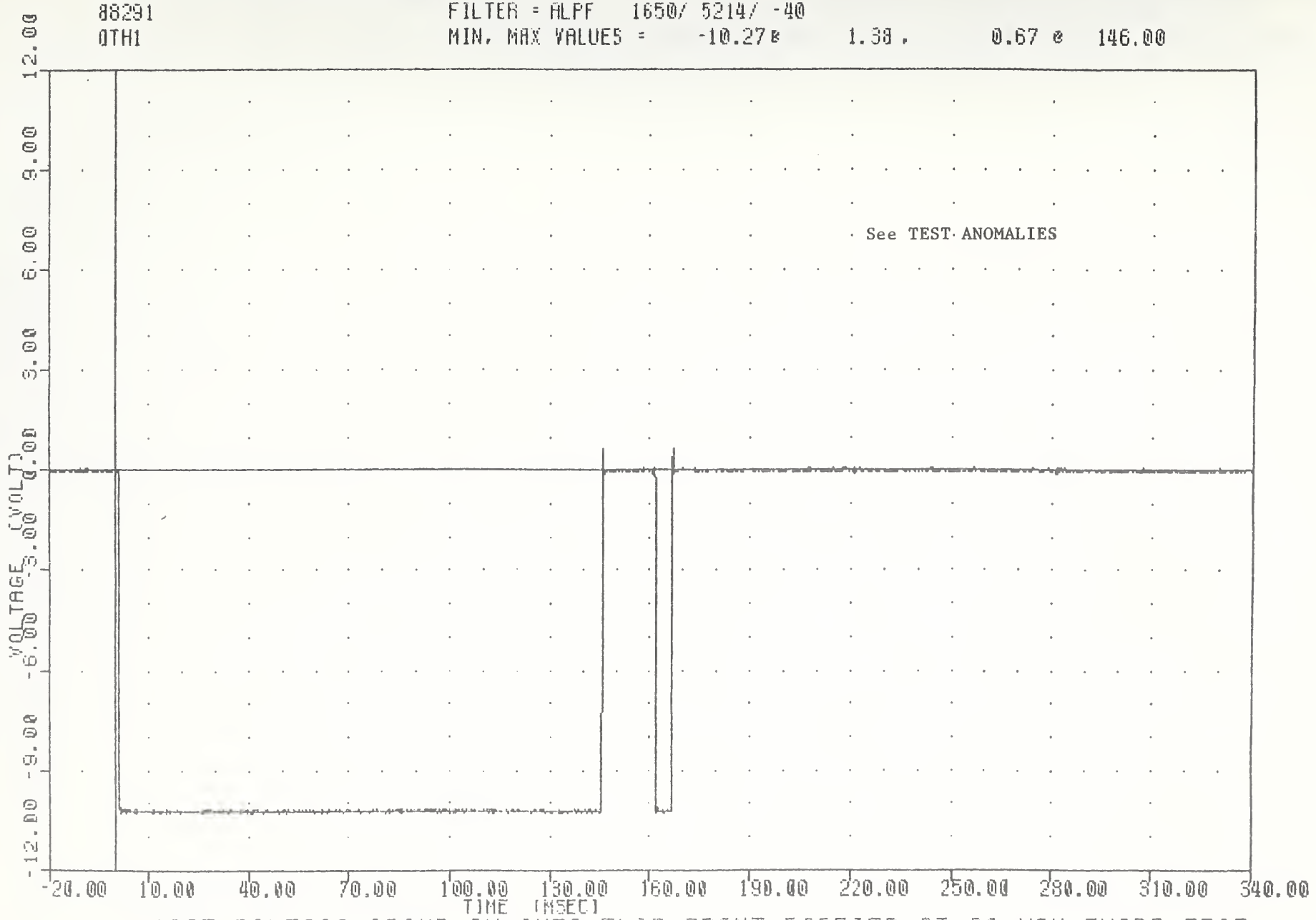


1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 20 MPH THIRD TEST
VEHICLE REAR DECK X AXIS VELOCITY REDUNDANT

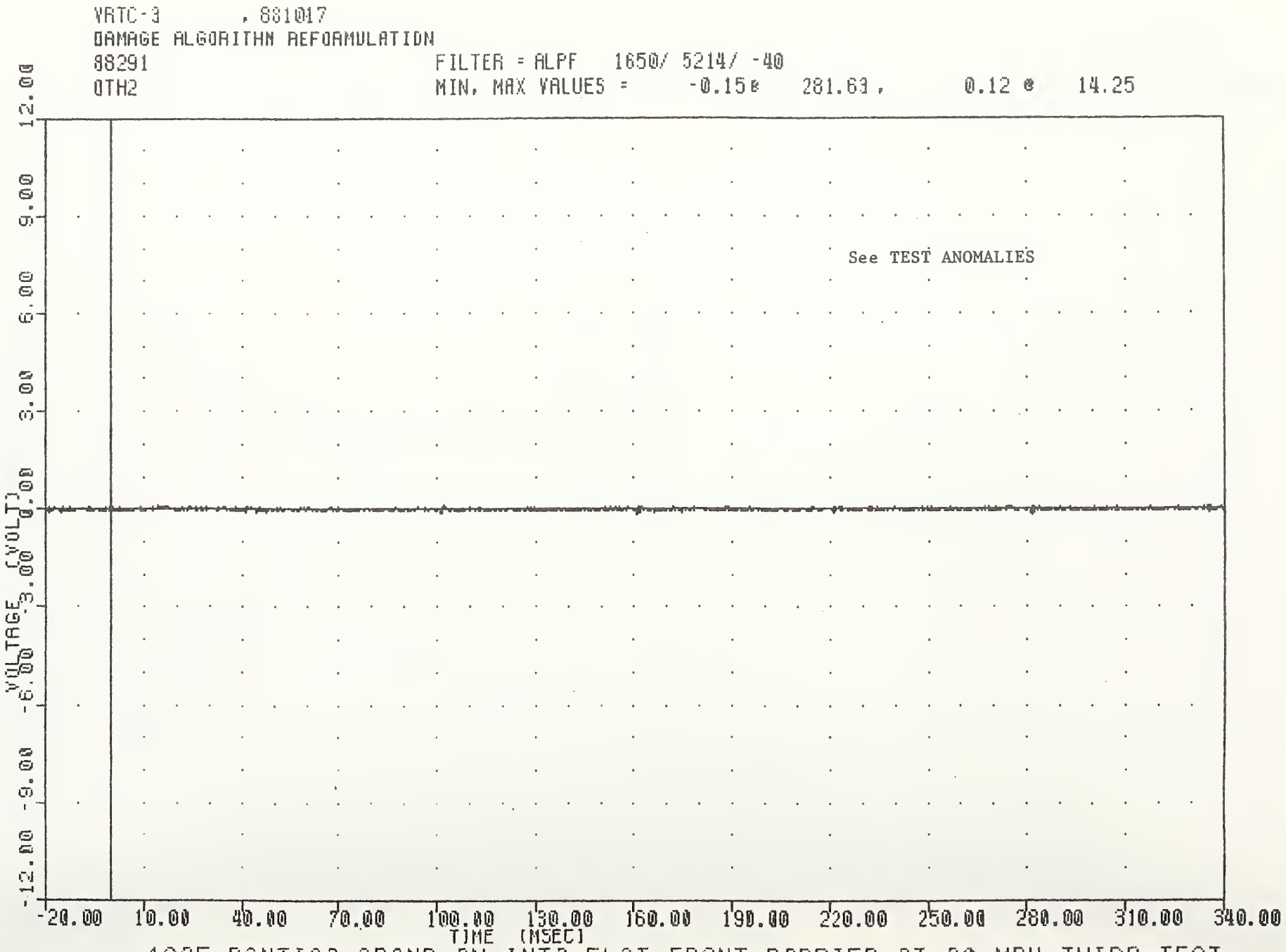


1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 20 MPH THIRD TEST
VEHICLE REAR DECK X AXIS DISPLACEMENT REDUNDANT

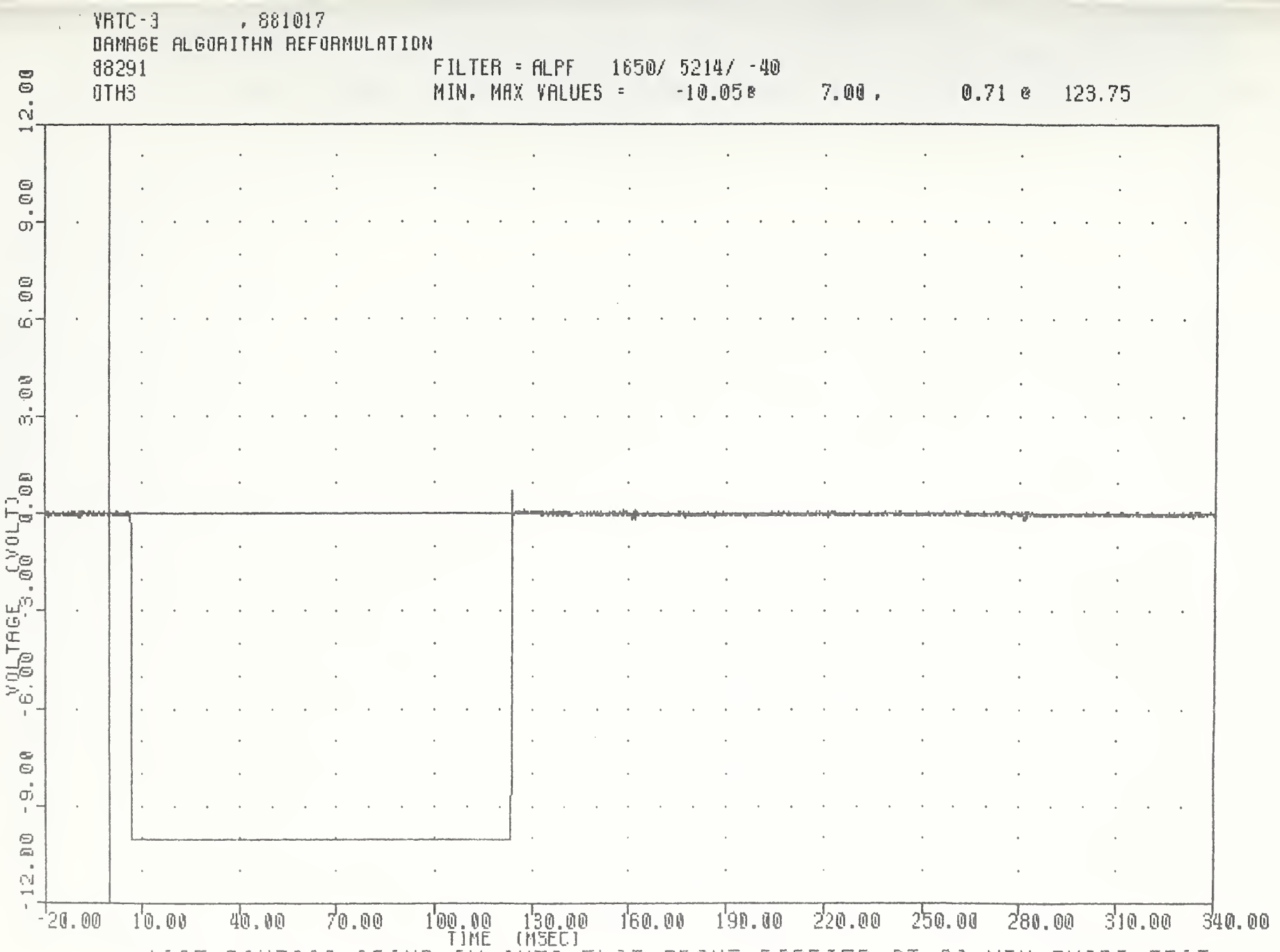
VRTC-3 881017
DAMAGE ALGORITHN REFORMULATION
88291 FILTER = ALPF 1650/ 5214/ -40
0TH1 MIN, MAX VALUES = -10.27 @ 1.38 , 0.67 @ 146.00



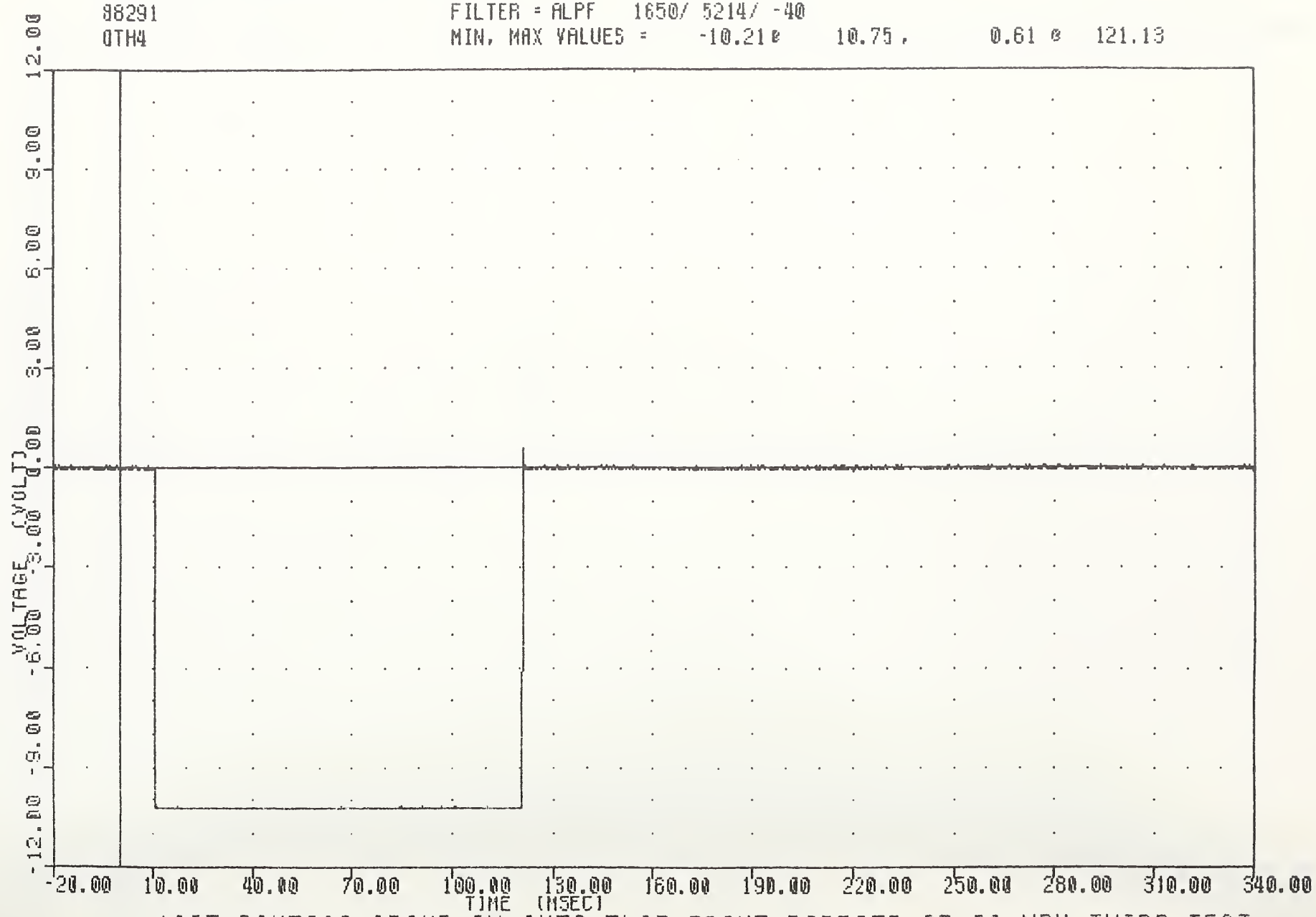
1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 20 MPH THIRD TEST
VEHICLE CONTACT SWITCH LEFT



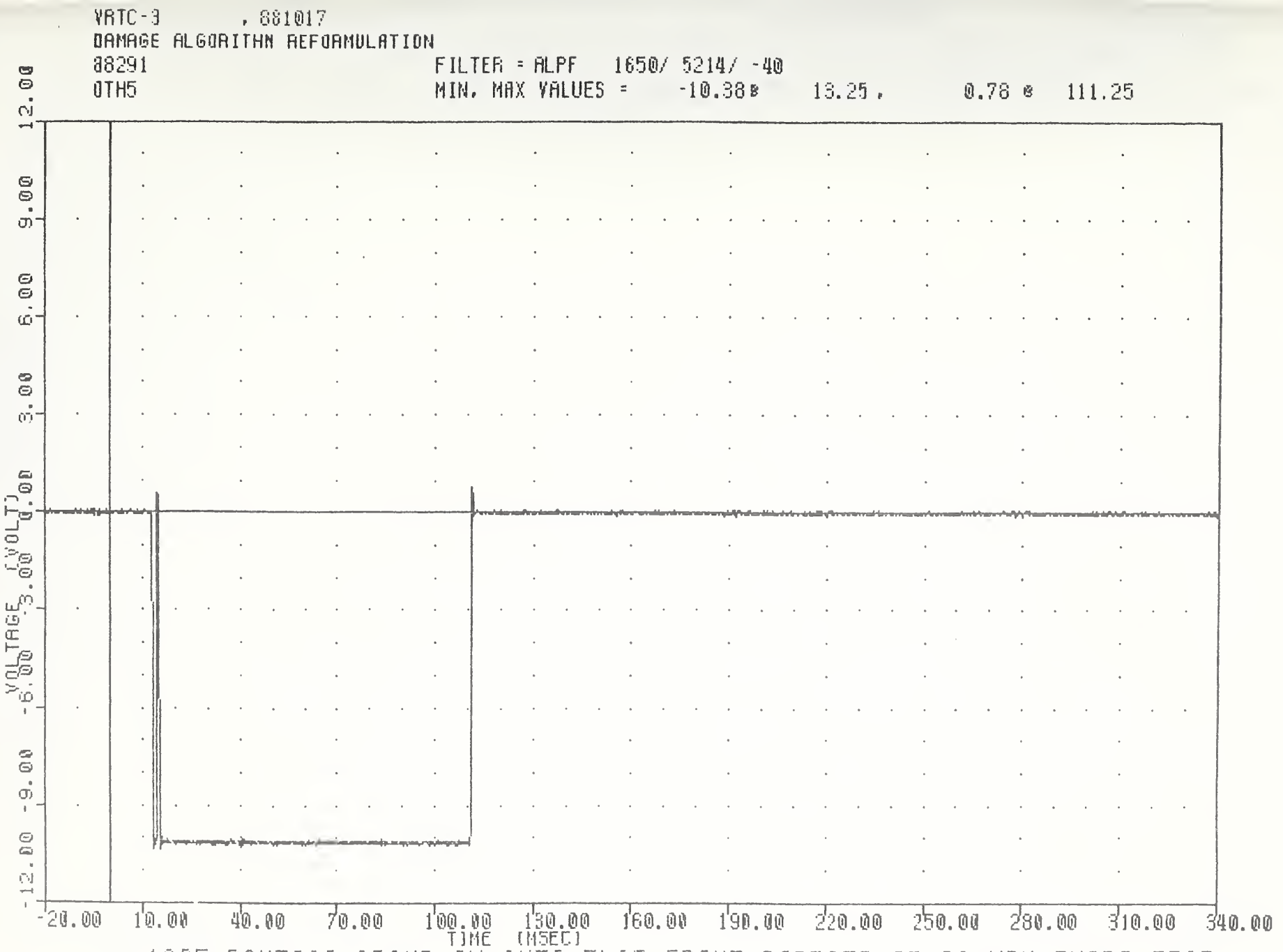
1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 20 MPH THIRD TEST
VEHICLE CONTACT SWITCH - CENTER



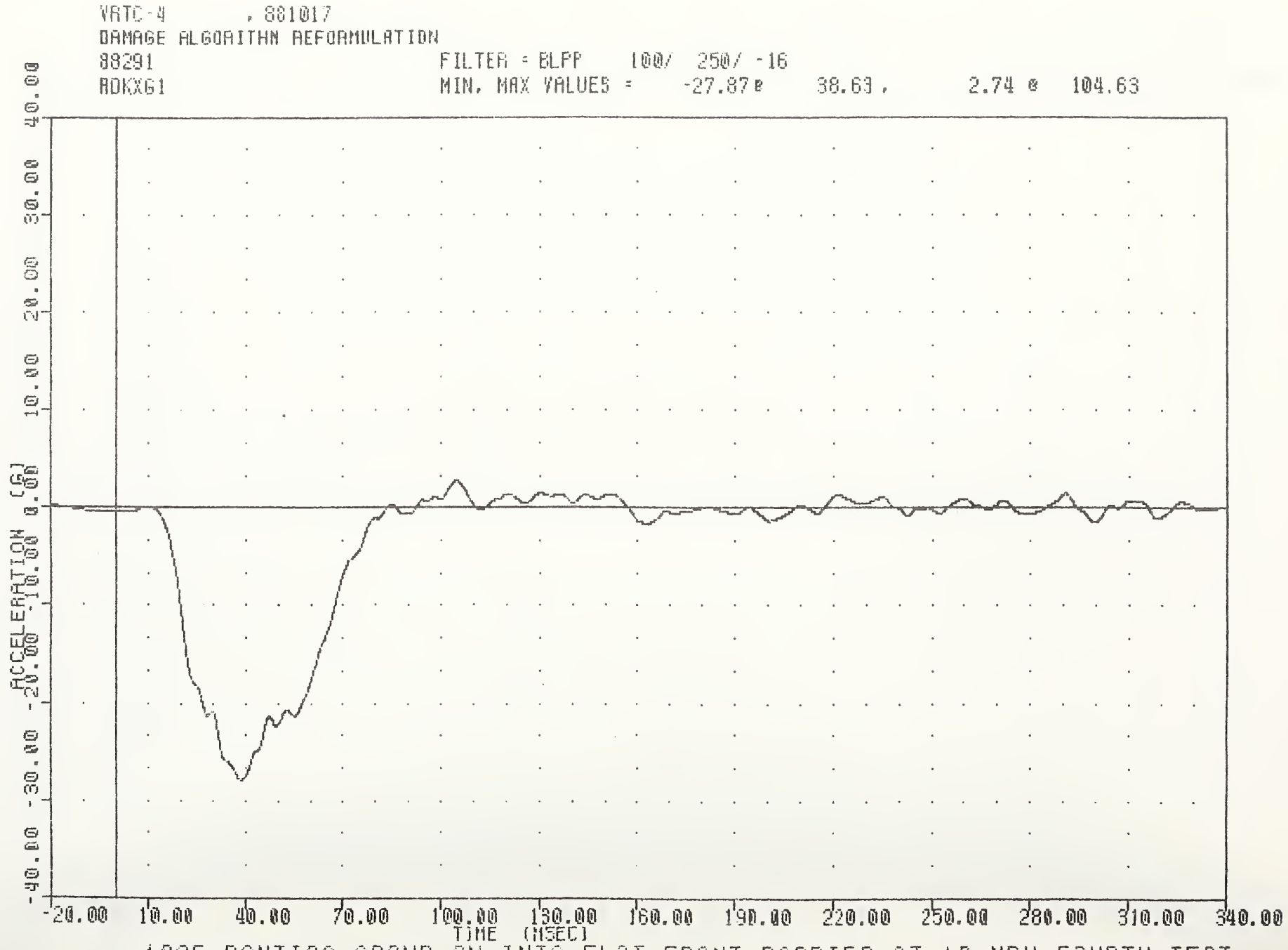
1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 20 MPH THIRD TEST
VEHICLE CONTACT SWITCH - RIGHT



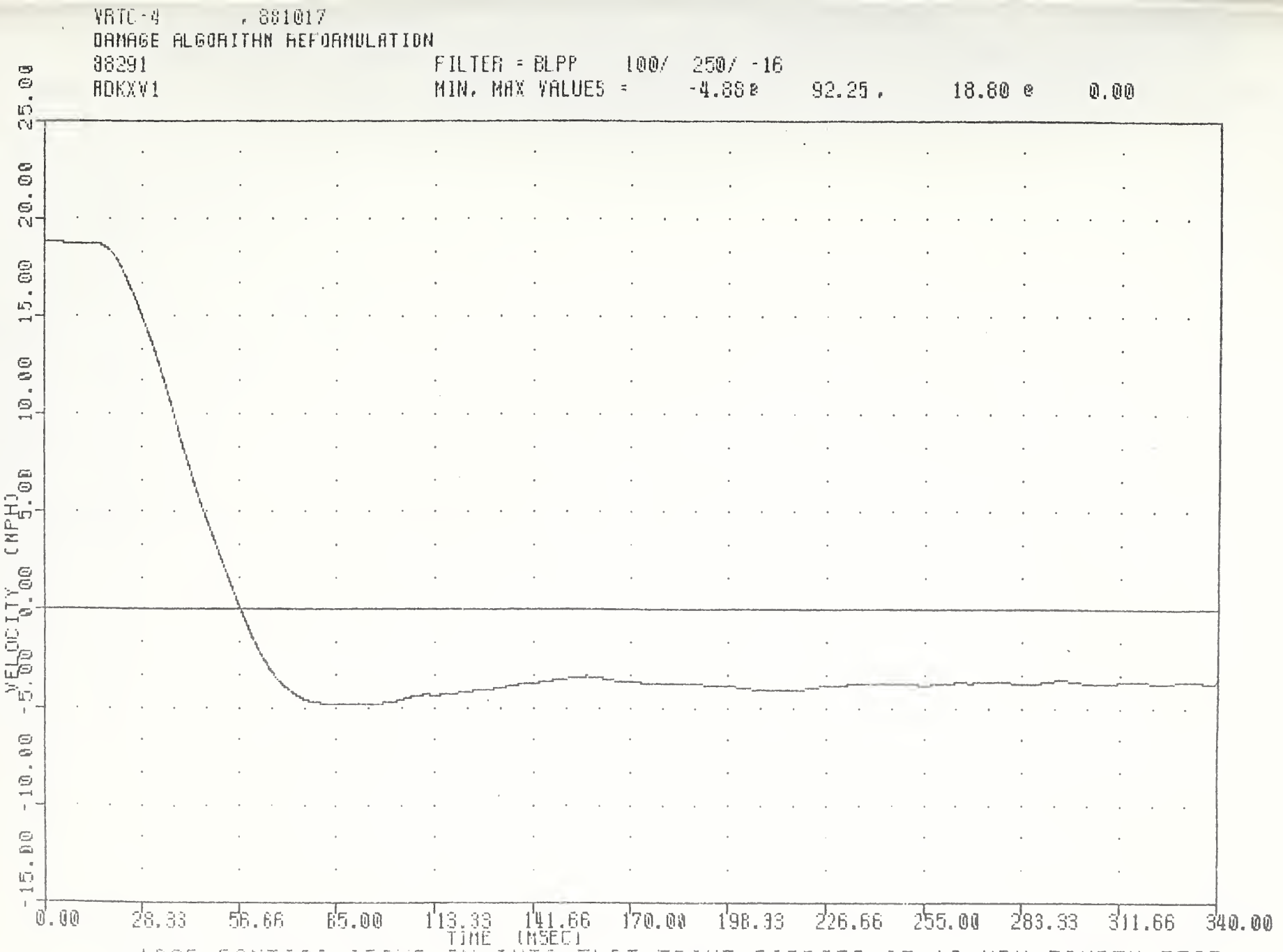
1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 20 MPH THIRD TEST
BARRIER CONTACT SWITCH - LEFT



1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 20 MPH THIRD TEST
BARRIER CONTACT SWITCH - RIGHT

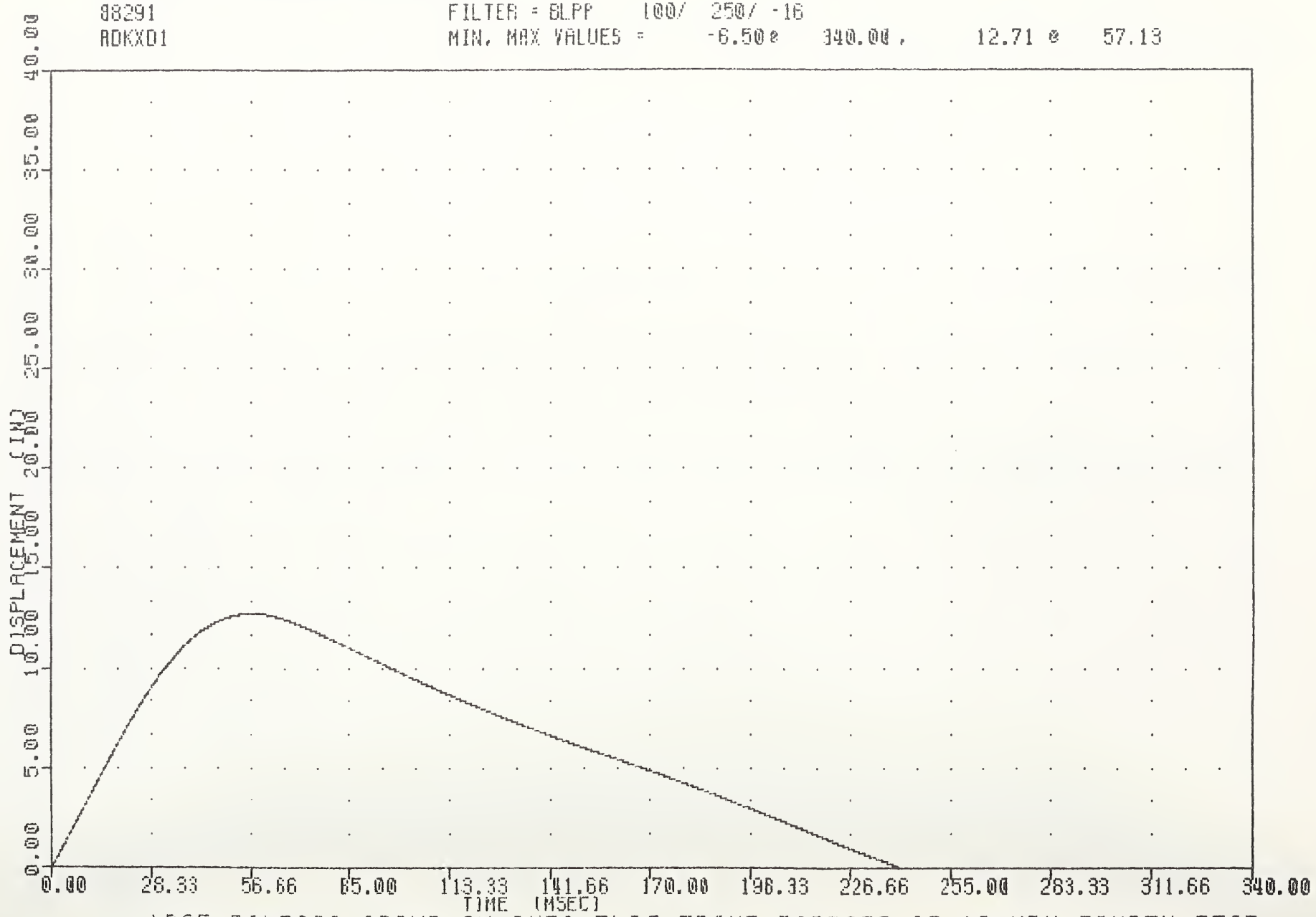


1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 18 MPH FOURTH TEST
VEHICLE REAR DECK X AXIS ACCELERATION

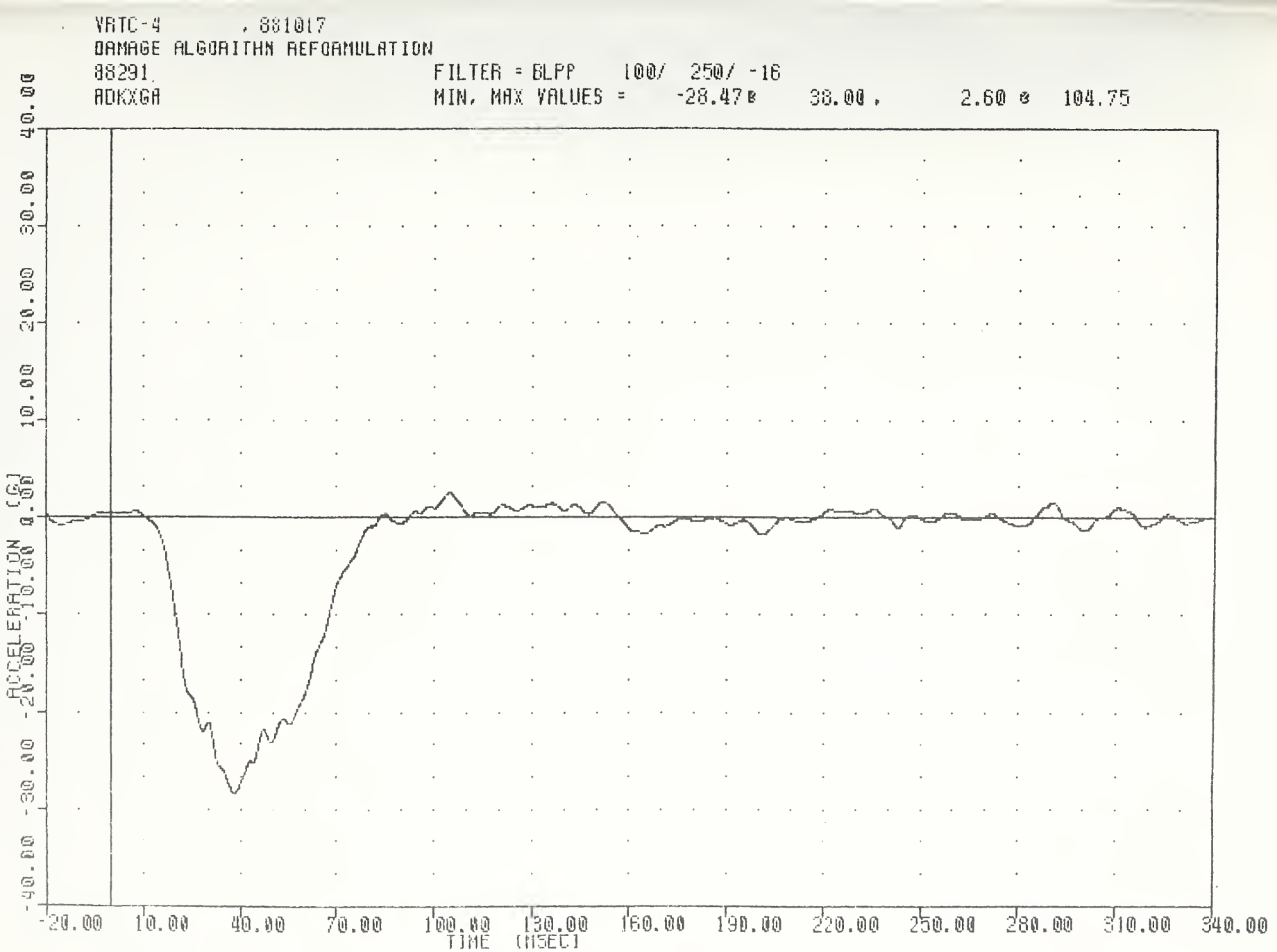


1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 18 MPH FOURTH TEST
VEHICLE REAR DECK X AXIS VELOCITY

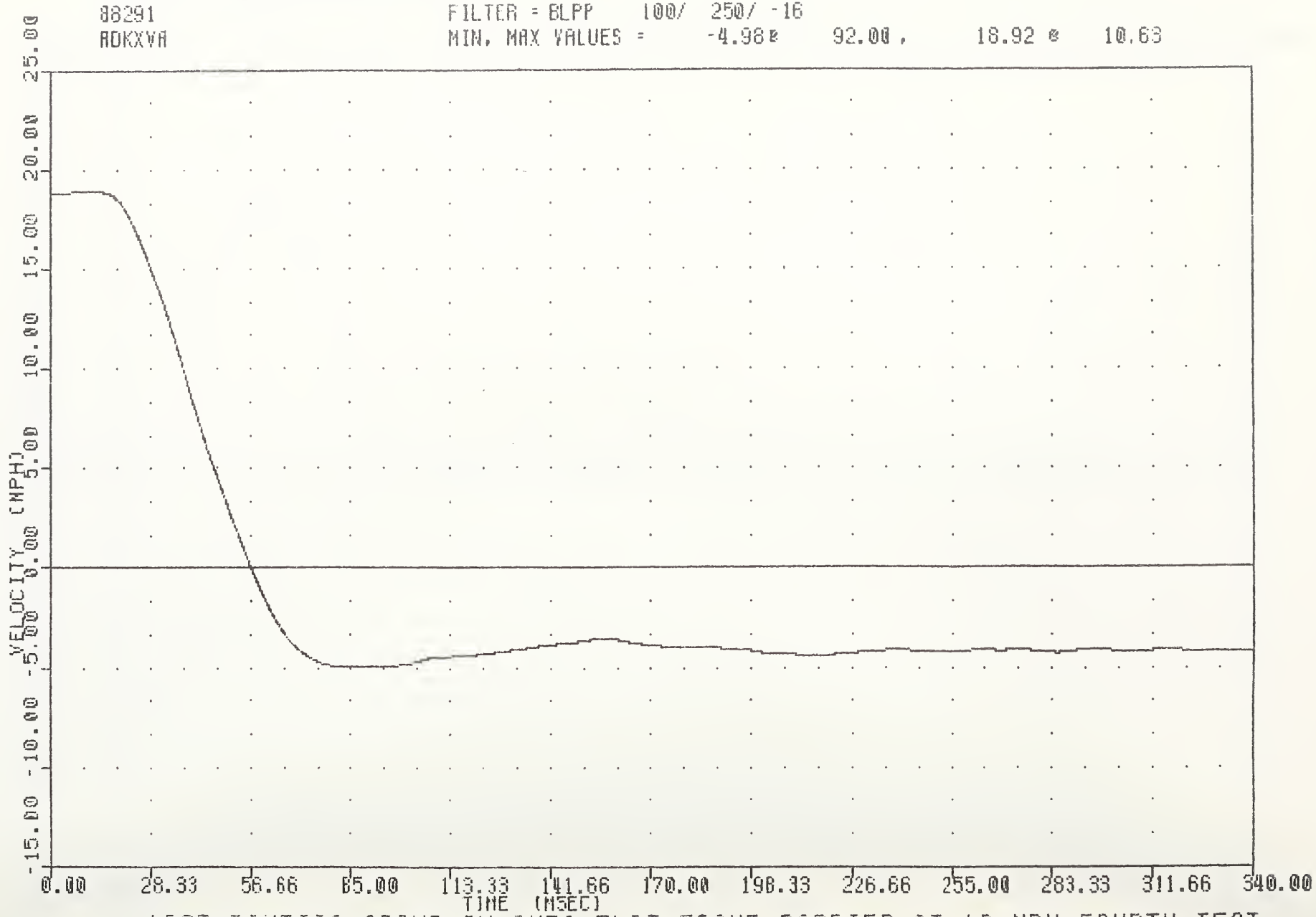
VRTC-4 , 881017
DAMAGE ALGORITHM REFORMULATION
88291 FILTER = BLPF 100/ 250/ -16
RDKXD1 MIN, MAX VALUES = -6.50 @ 340.00 , 12.71 @ 57.13



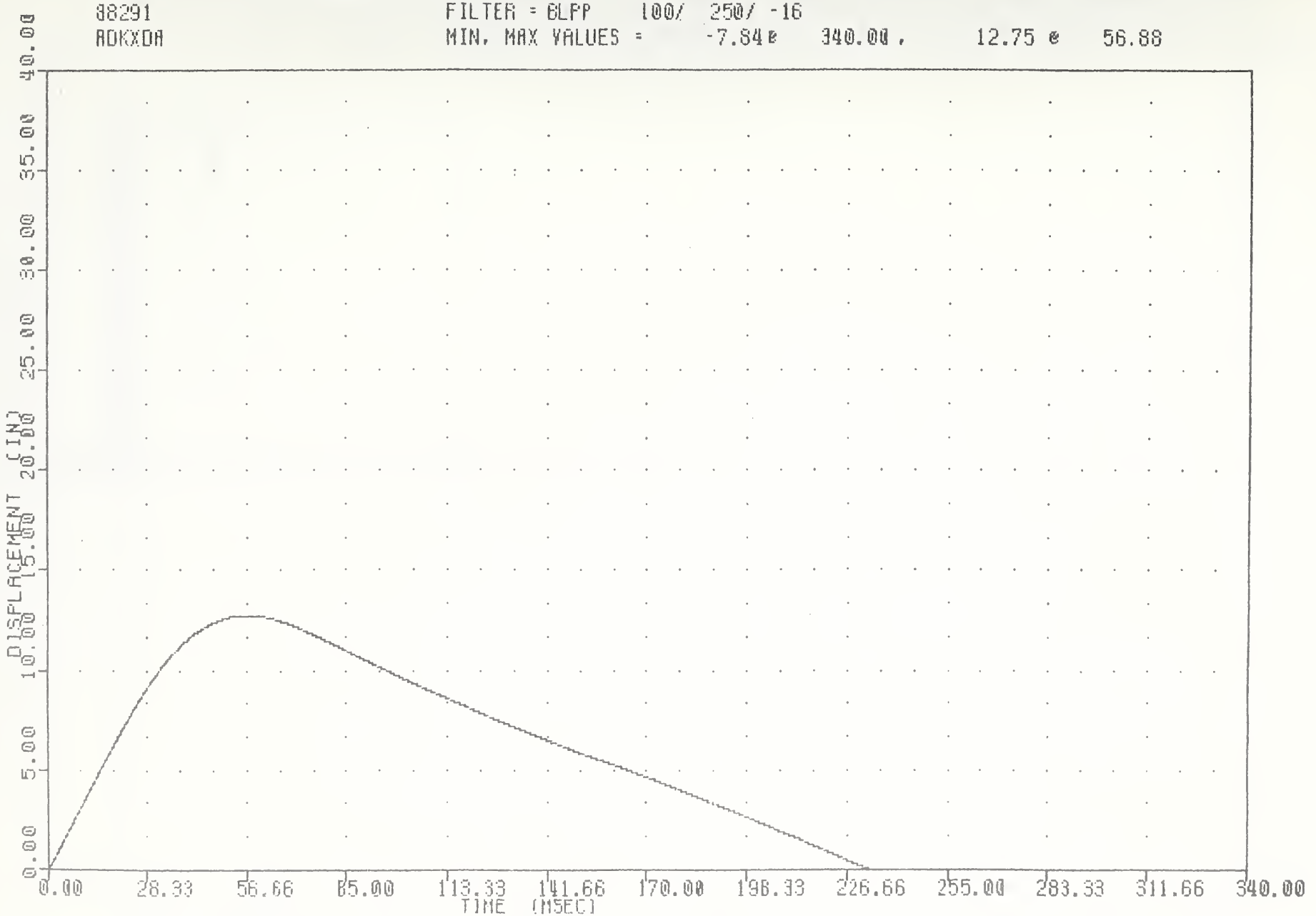
1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 18 MPH FOURTH TEST
VEHICLE REAR DECK X AXIS DISPLACEMENT



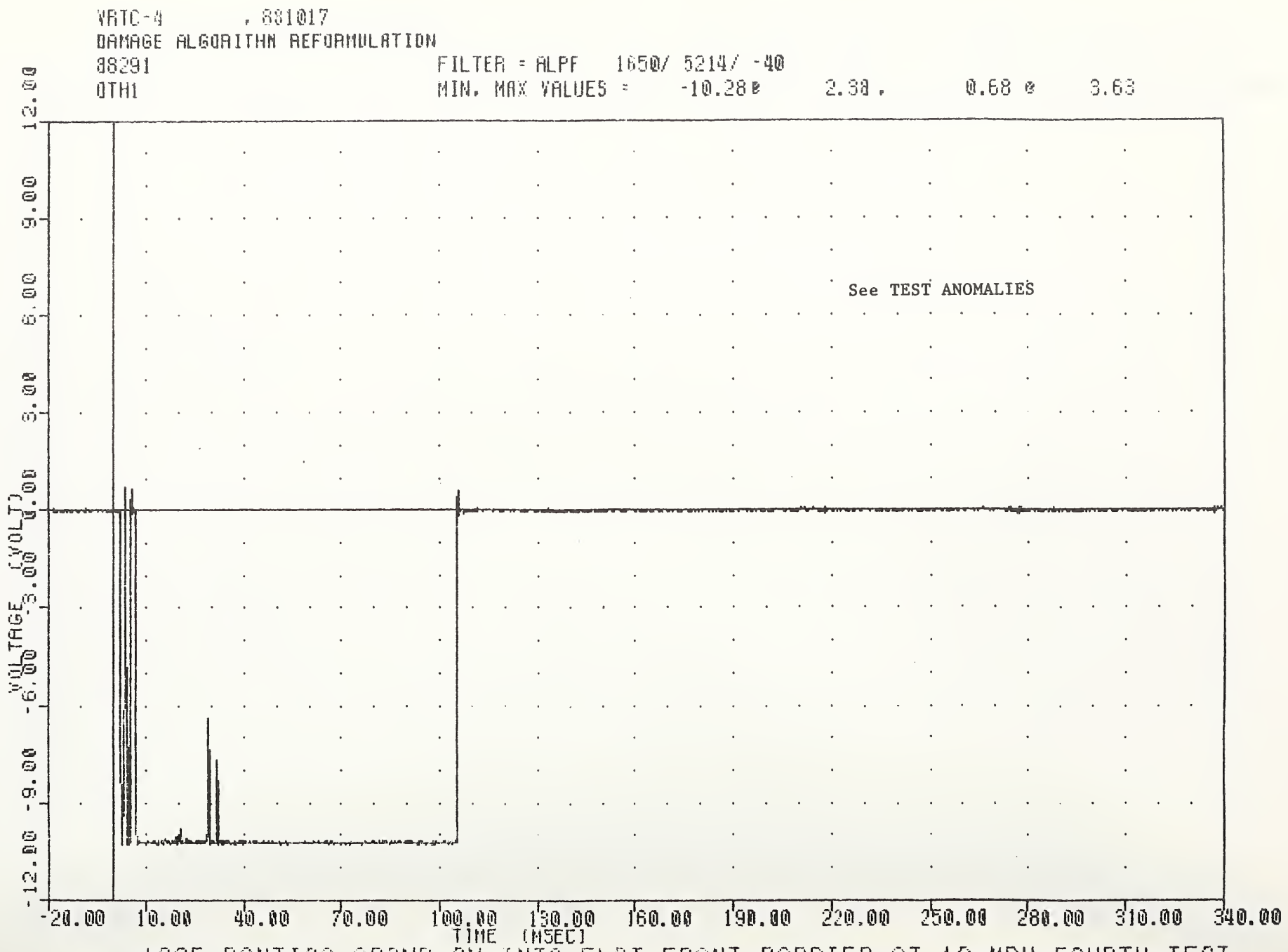
1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 18 MPH FOURTH TEST
VEHICLE REAR DECK X AXIS REDUNDANT ACCELERATION



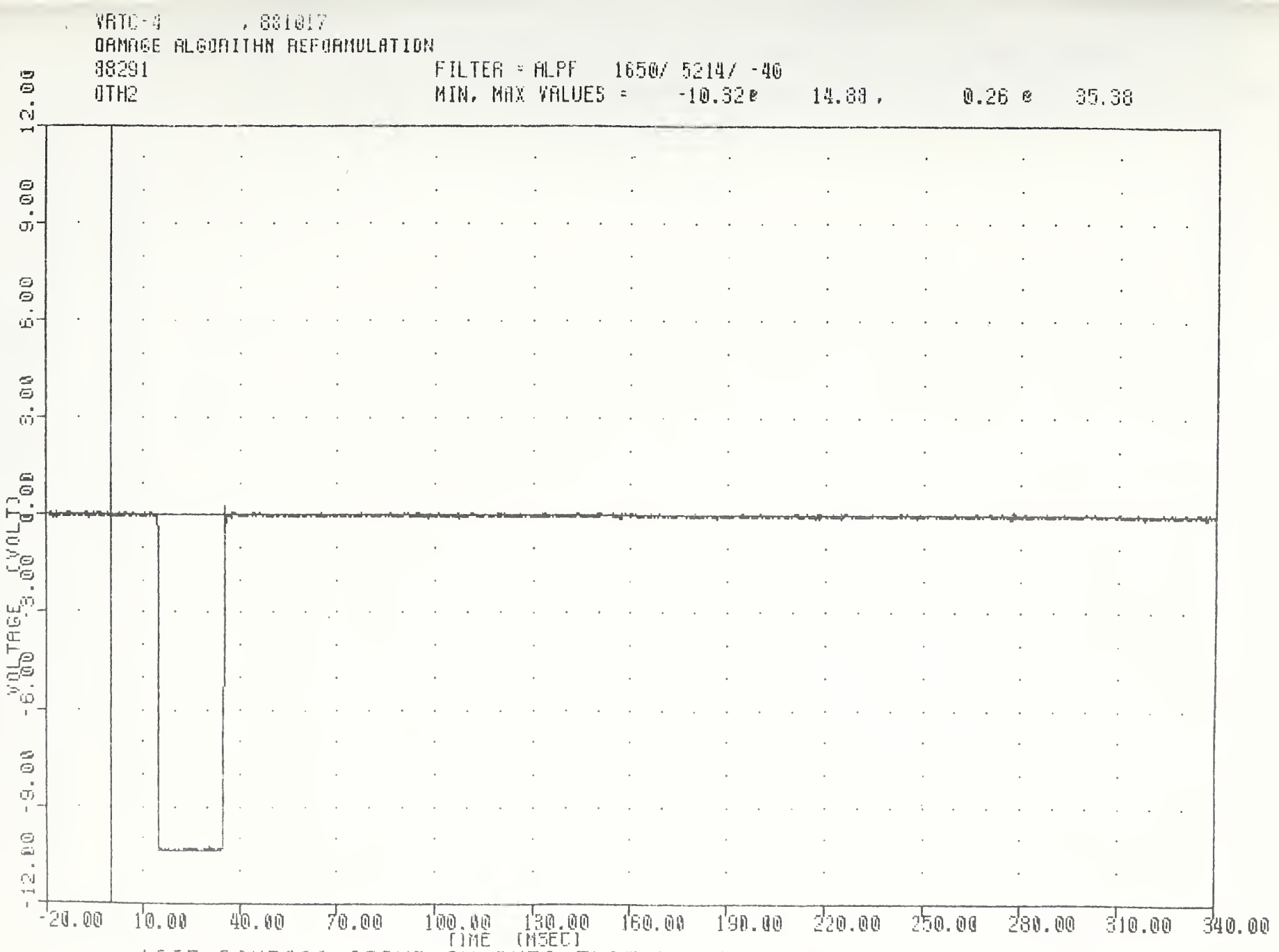
1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 18 MPH FOURTH TEST
VEHICLE REAR DECK X AXIS VELOCITY REDUNDANT



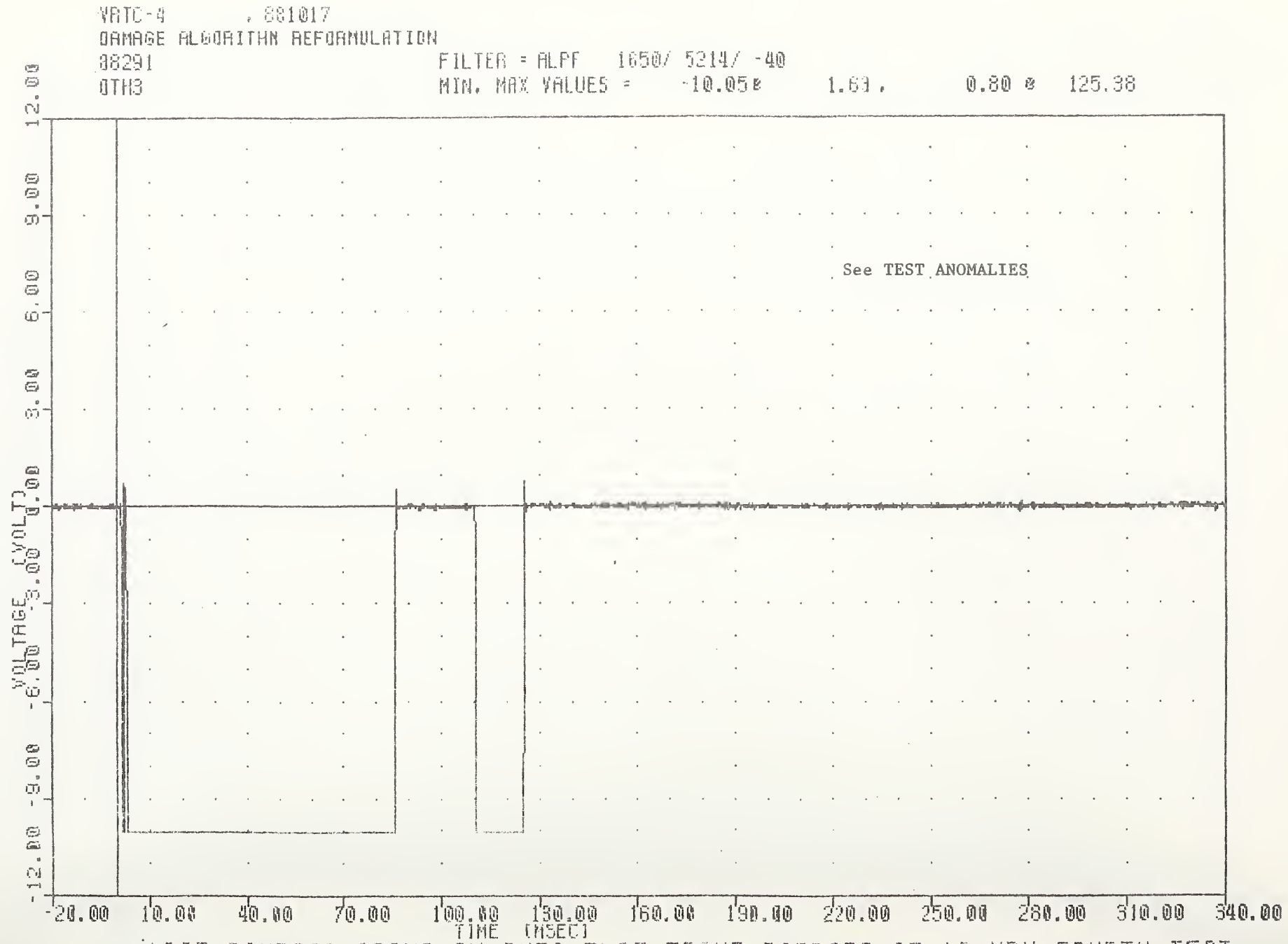
1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 18 MPH FOURTH TEST
VEHICLE REAR DECK X AXIS DISPLACEMENT REDUNDANT



1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 18 MPH FOURTH TEST
VEHICLE CONTACT SWITCH - LEFT

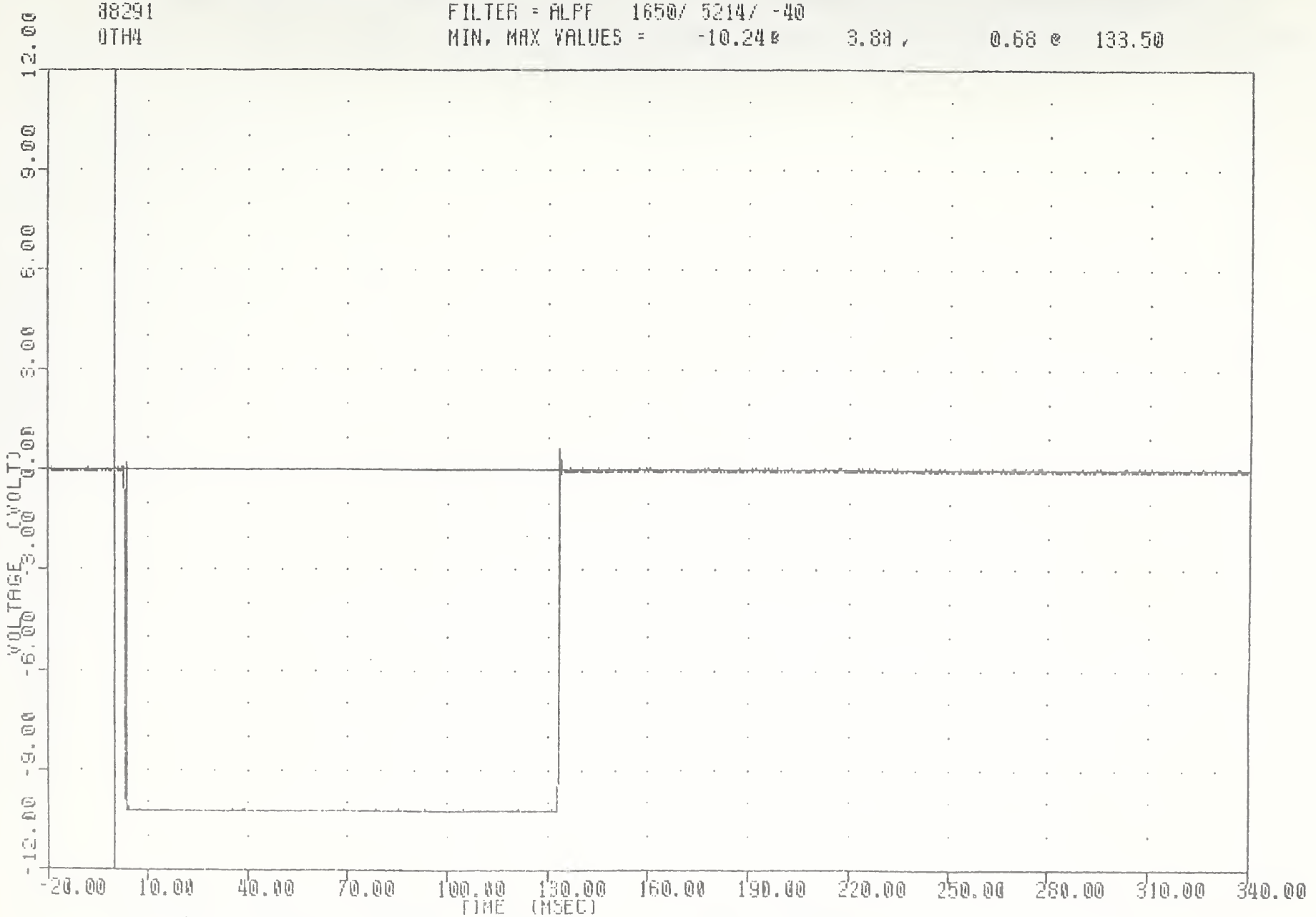


1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 18 MPH FOURTH TEST
VEHICLE CONTACT SWITCH - CENTER

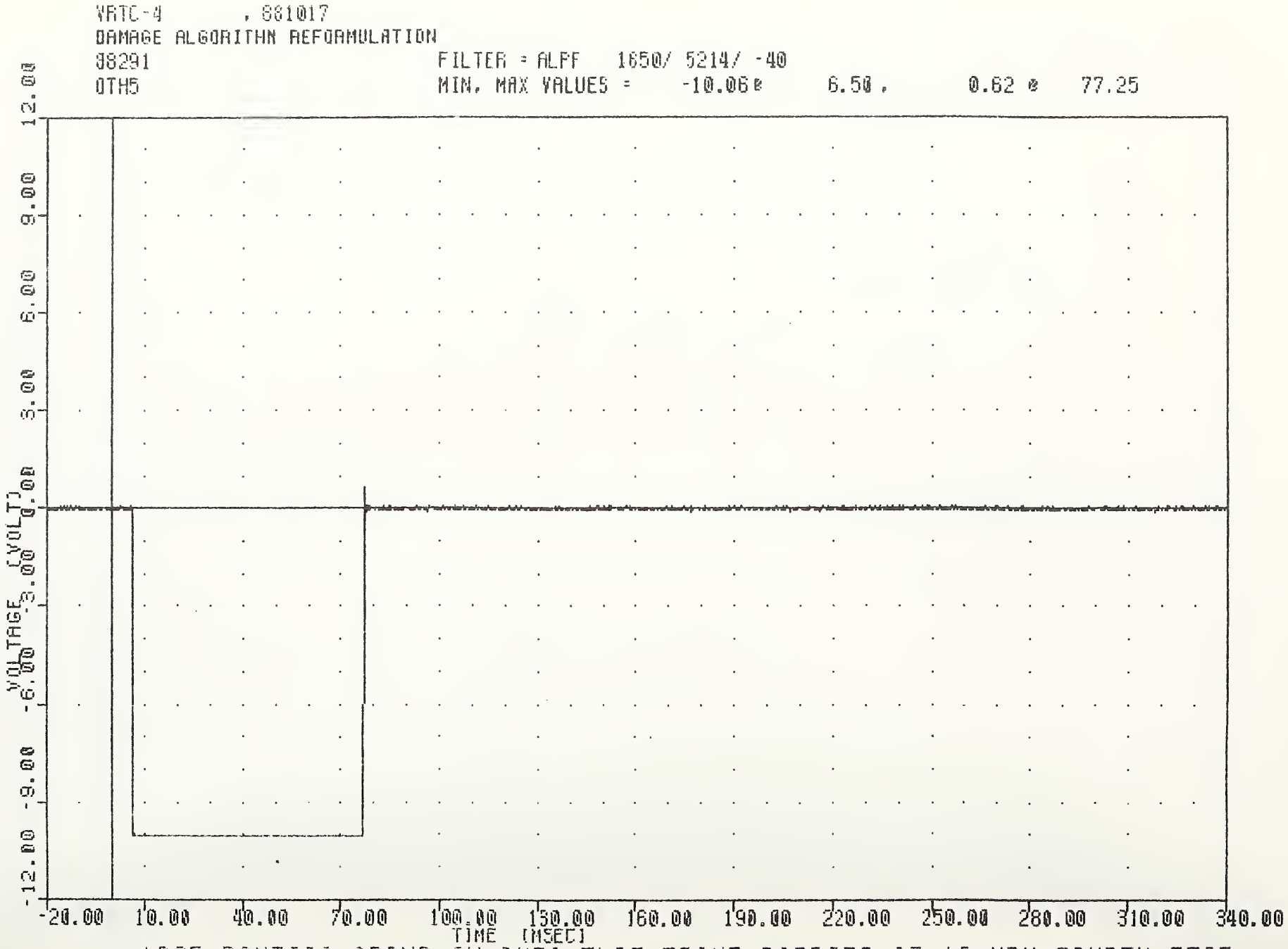


1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 18 MPH FOURTH TEST
VEHICLE CONTACT SWITCH - RIGHT

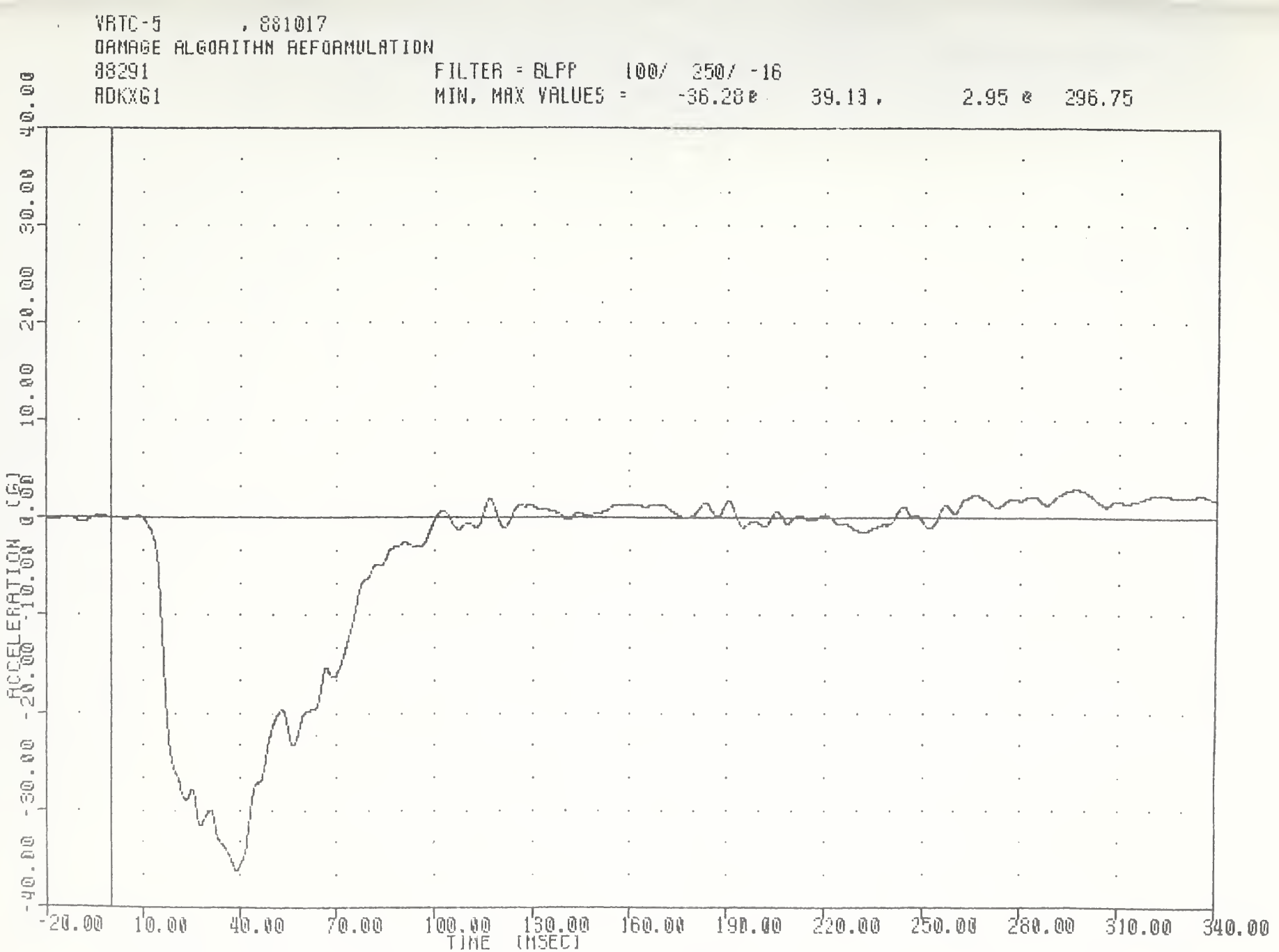
VRTC-4 , 881017
DAMAGE ALGORITHM REFORMULATION
88291 FILTER = ALPF 1650/ 5214/ -40
0TH4 MIN, MAX VALUES = -10.24 @ 3.88 , 0.68 @ 133.50



1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 18 MPH FOURTH TEST
BARRIER CONTACT SWITCH - LEFT

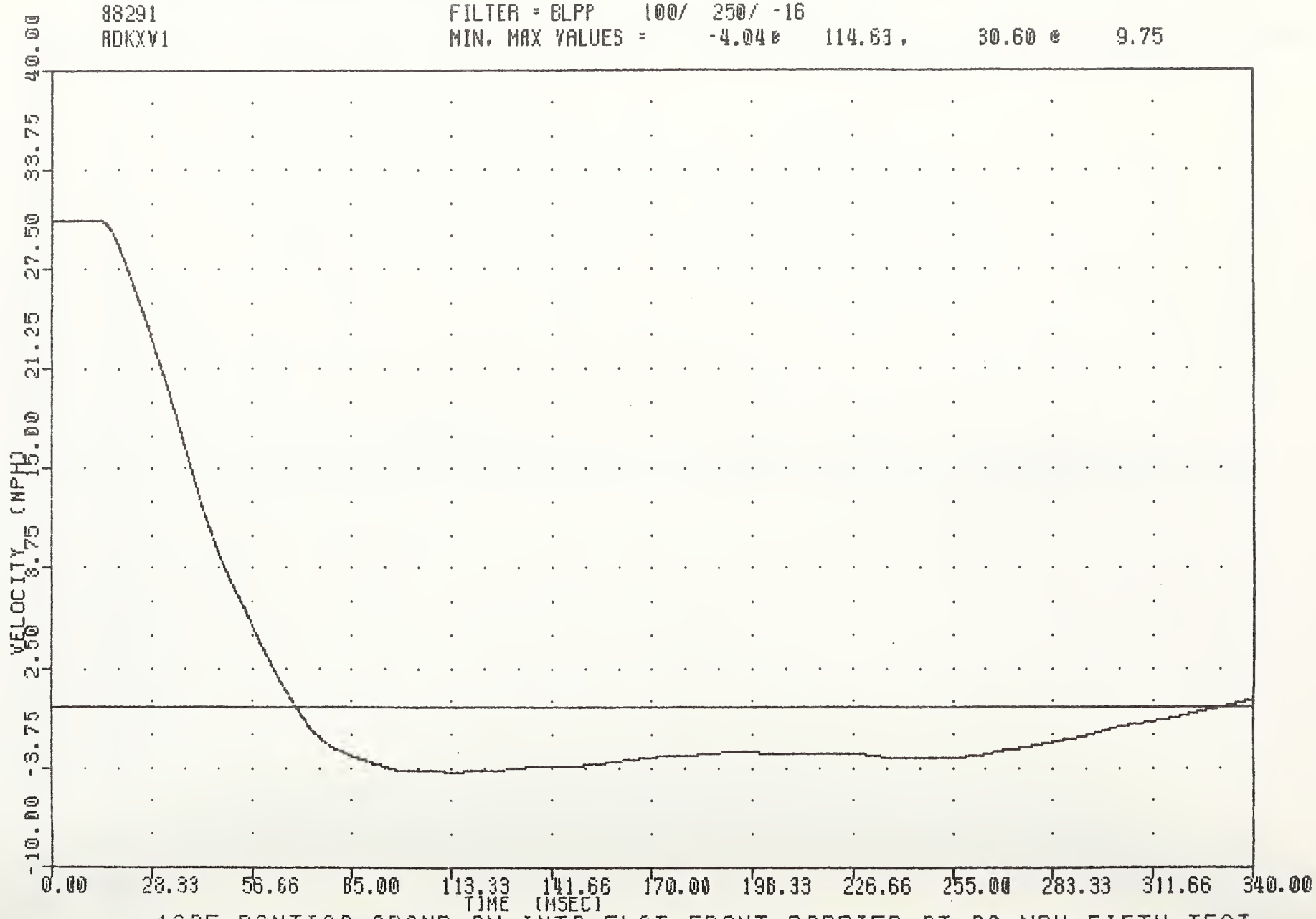


1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 18 MPH FOURTH TEST
BARRIER CONTACT SWITCH - RIGHT



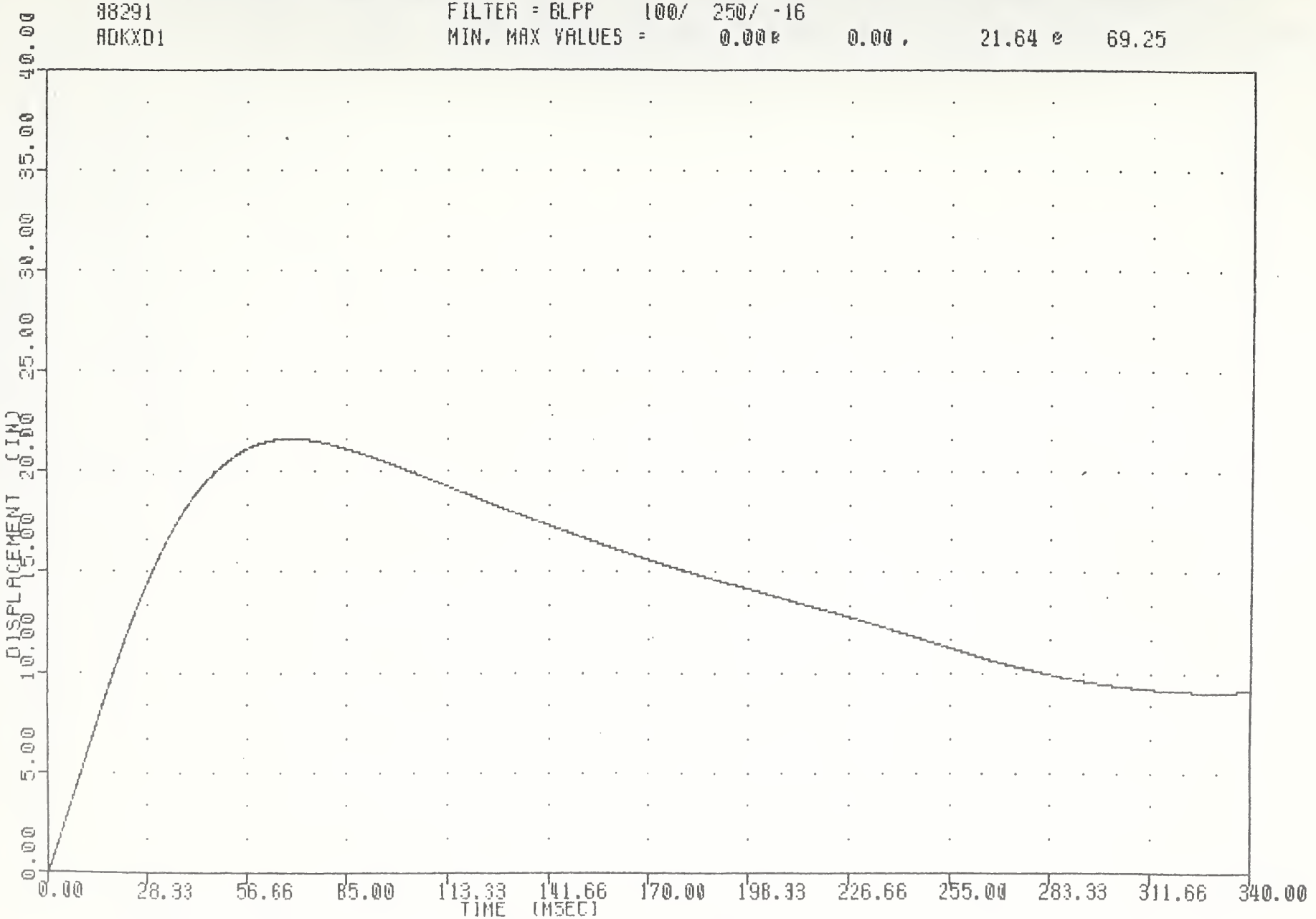
1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 30 MPH FIFTH TEST
VEHICLE REAR DECK X AXIS ACCELERATION

VRTC-5 , 881017
DAMAGE ALGORITHN REFORMULATION
88291 FILTER = BLPP 100/ 250/ -16
RDKXV1 MIN, MAX VALUES = -4.04 @ 114.63 , 30.60 @ 9.75

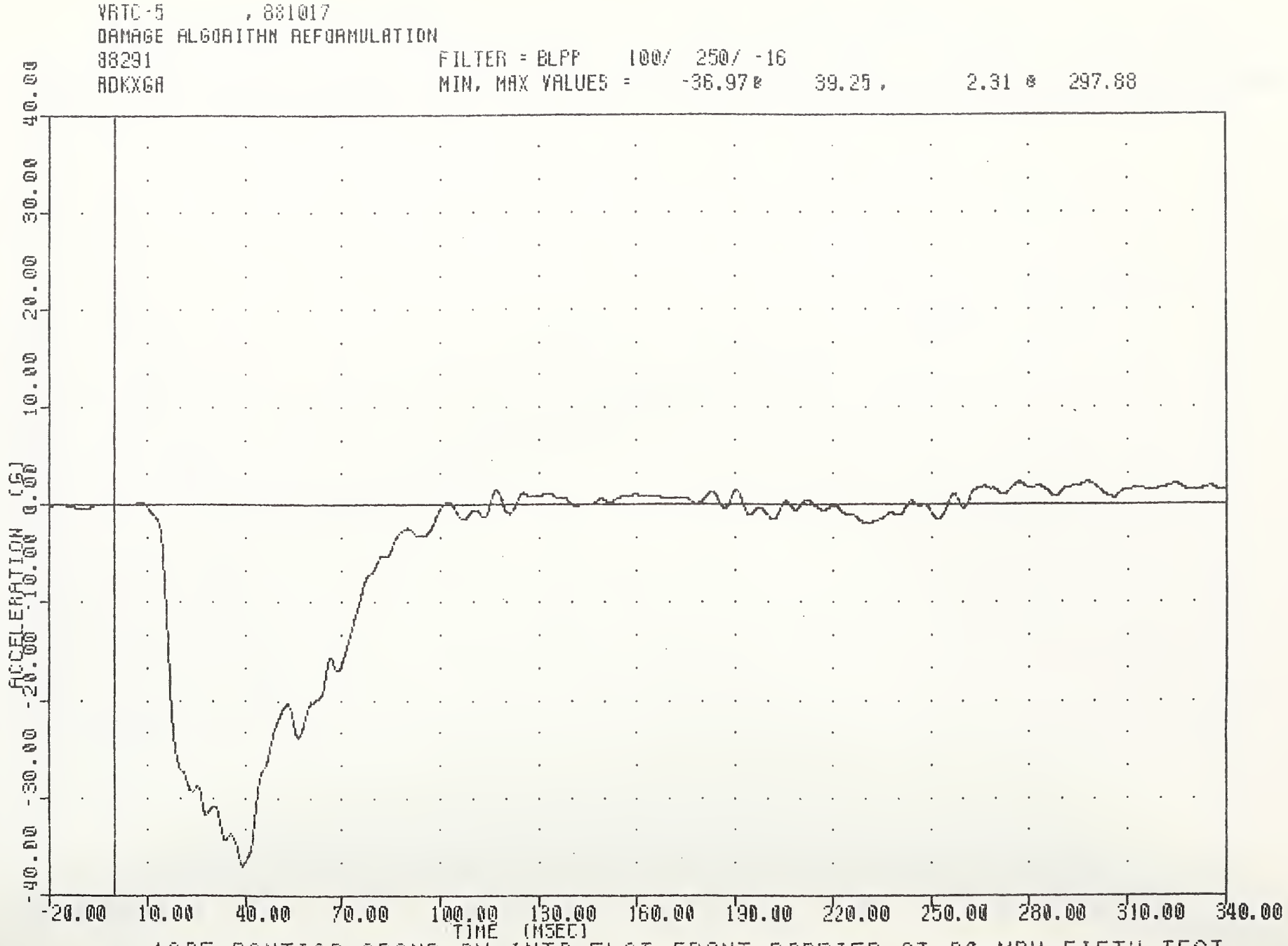


1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 30 MPH FIFTH TEST
VEHICLE REAR DECK X AXIS VELOCITY

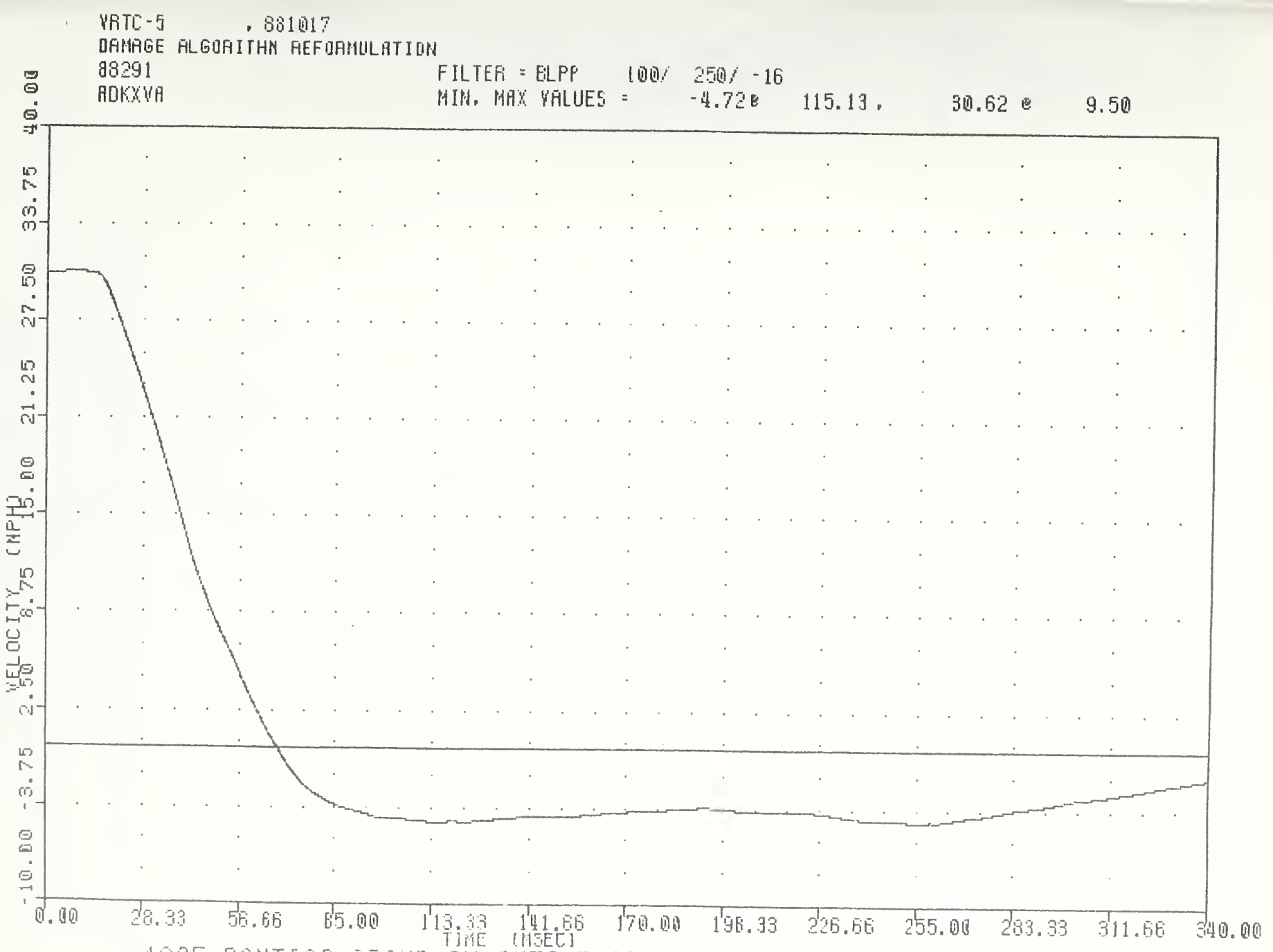
VRTC-5 , 881017
DAMAGE ALGORITHM REFORMULATION
88291 FILTER = BLPP 100/ 250/ -16
RDKXD1 MIN, MAX VALUES = 0.00@ 0.00 , 21.64 @ 69.25



1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 30 MPH FIFTH TEST
VEHICLE REAR DECK X AXIS DISPLACEMENT

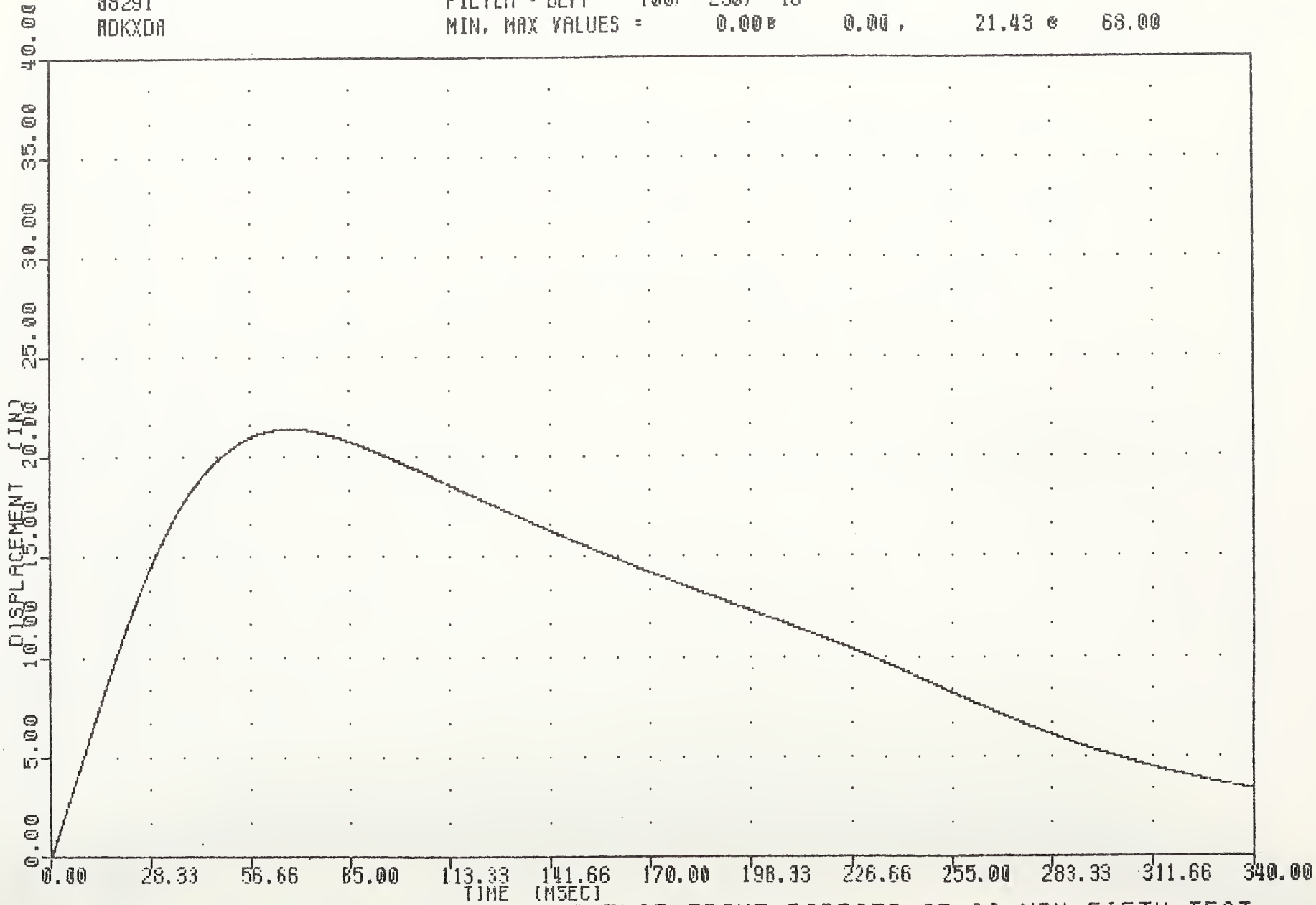


1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 30 MPH FIFTH TEST
VEHICLE REAR DECK X AXIS REDUNDANT ACCELERATION

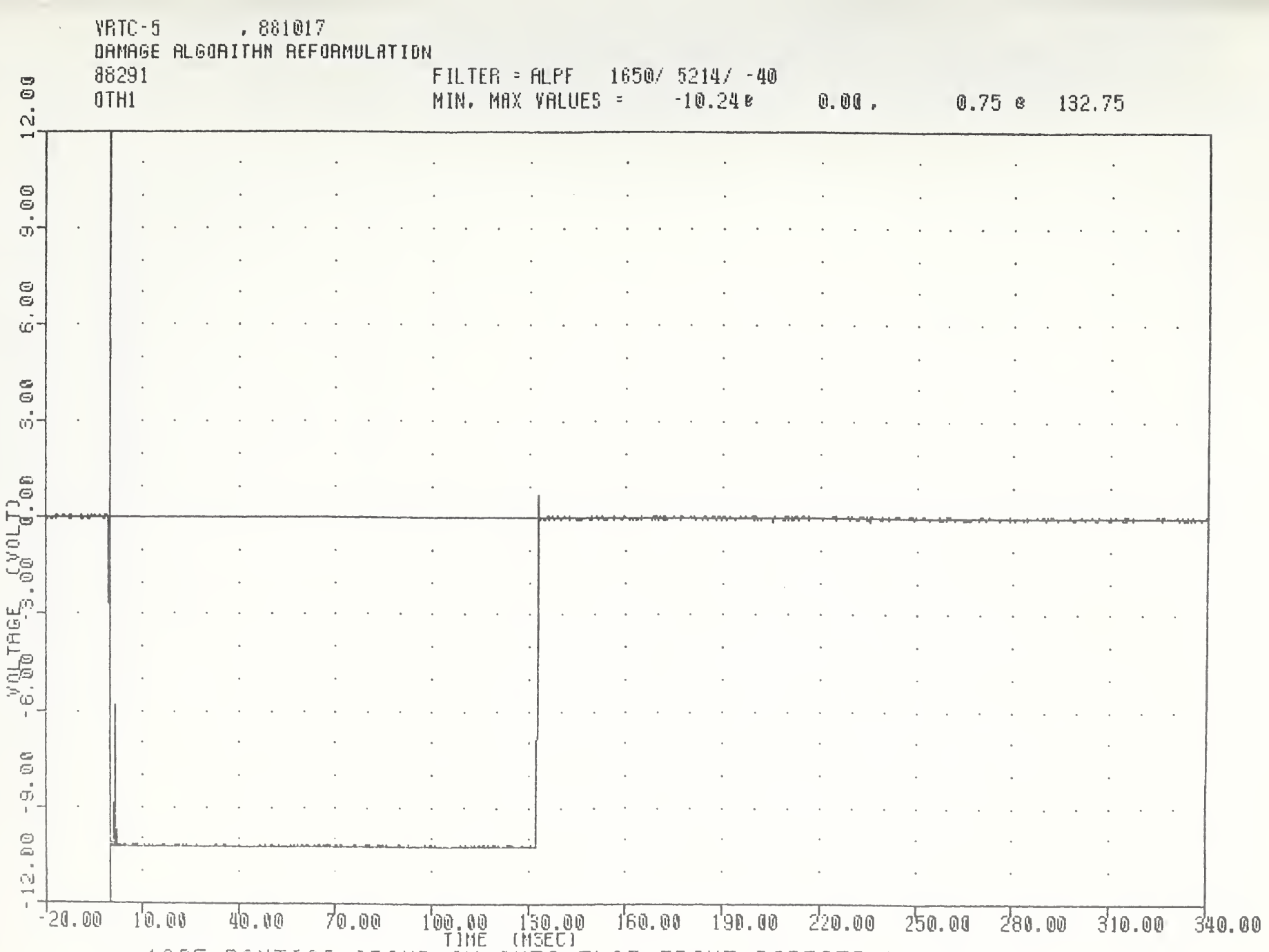


1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 30 MPH FIFTH TEST
VEHICLE REAR DECK X AXIS VELOCITY REDUNDANT

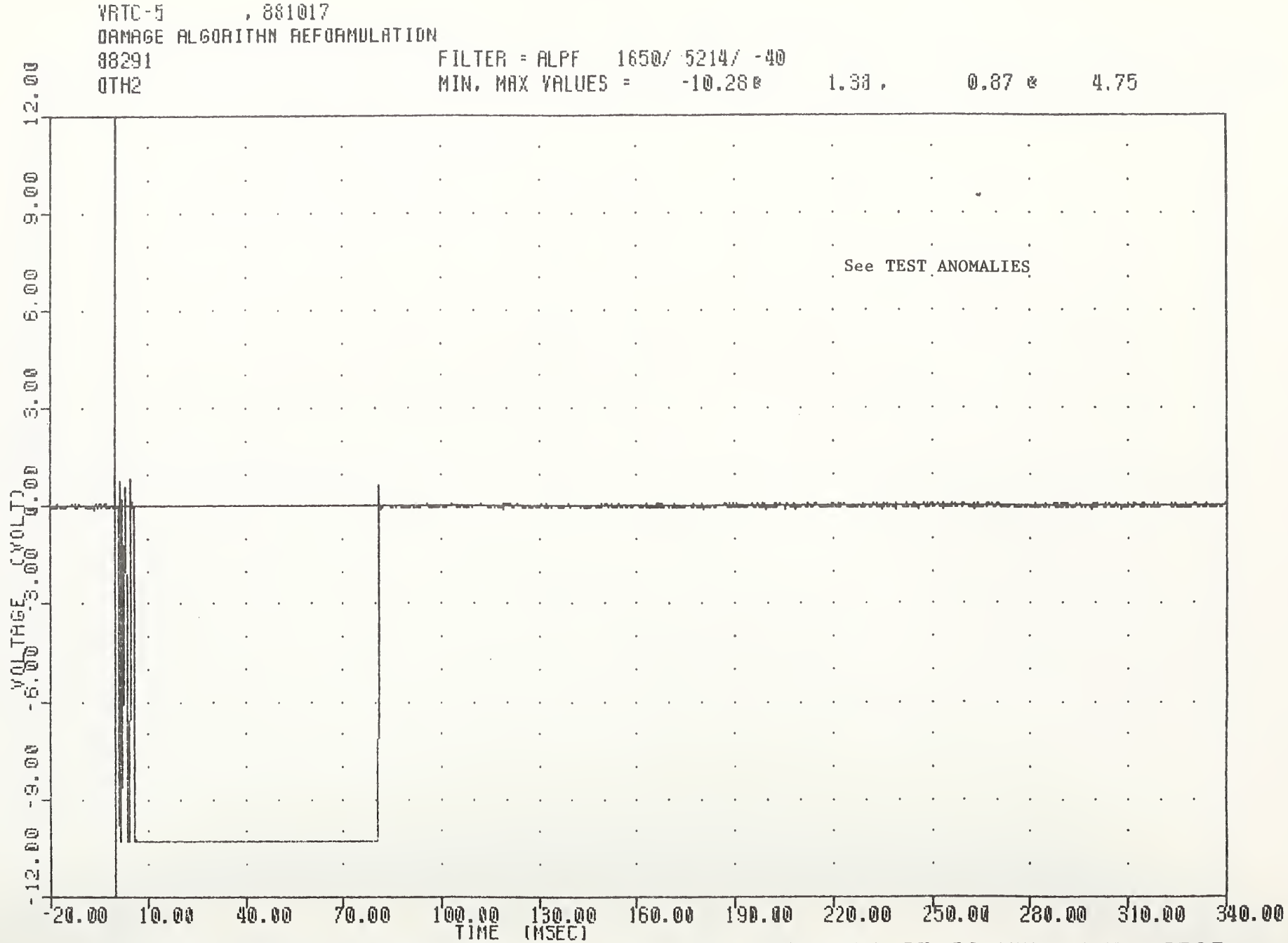
VRTC-5 , 881017
DAMAGE ALGORITHM REFORMULATION
88291 FILTER = BLPP 100/ 250/ -16
RDKXDA MIN, MAX VALUES = 0.00 @ 0.00 , 21.43 @ 68.00



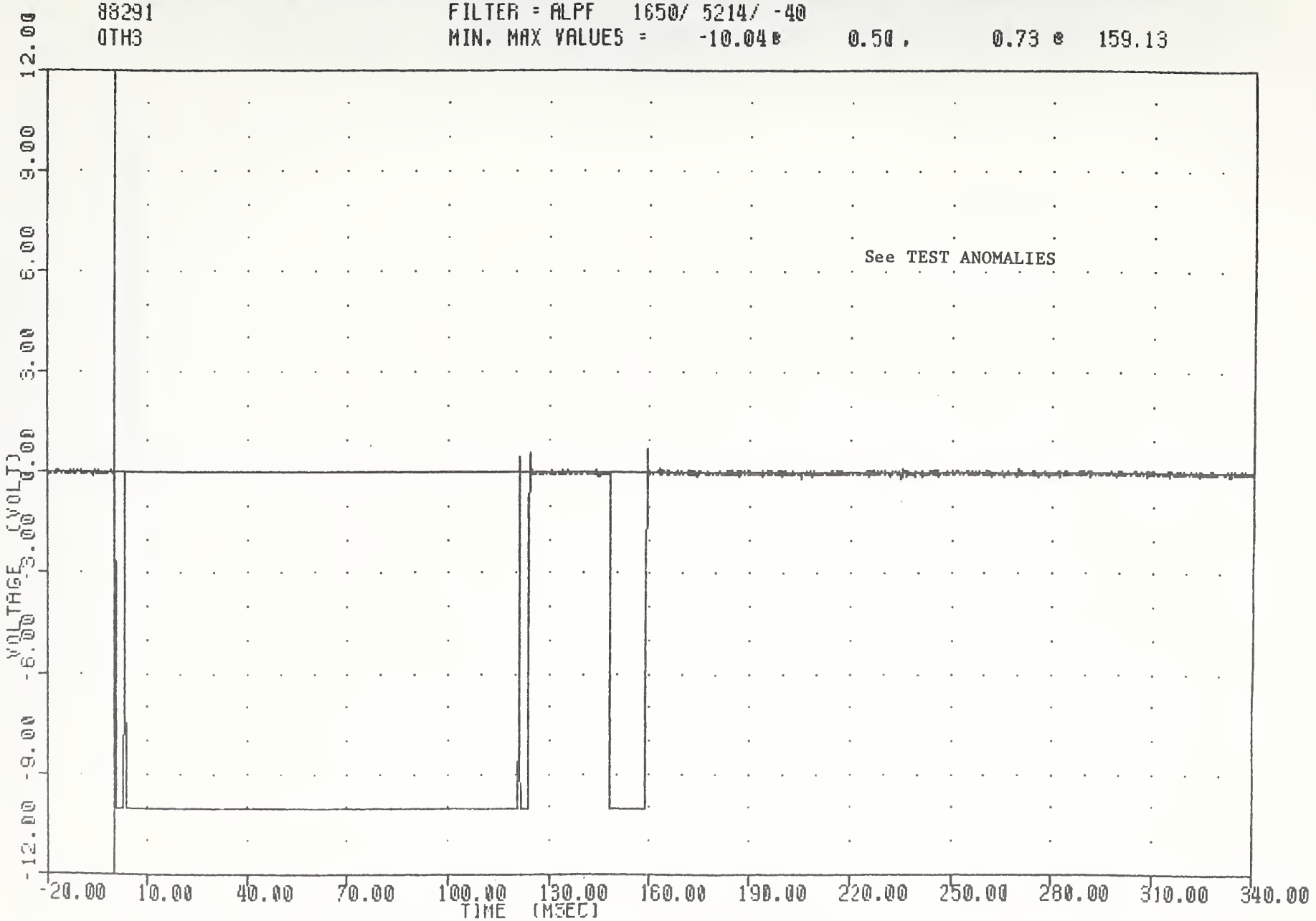
1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 30 MPH FIFTH TEST
VEHICLE REAR DECK X AXIS DISPLACEMENT REDUNDANT



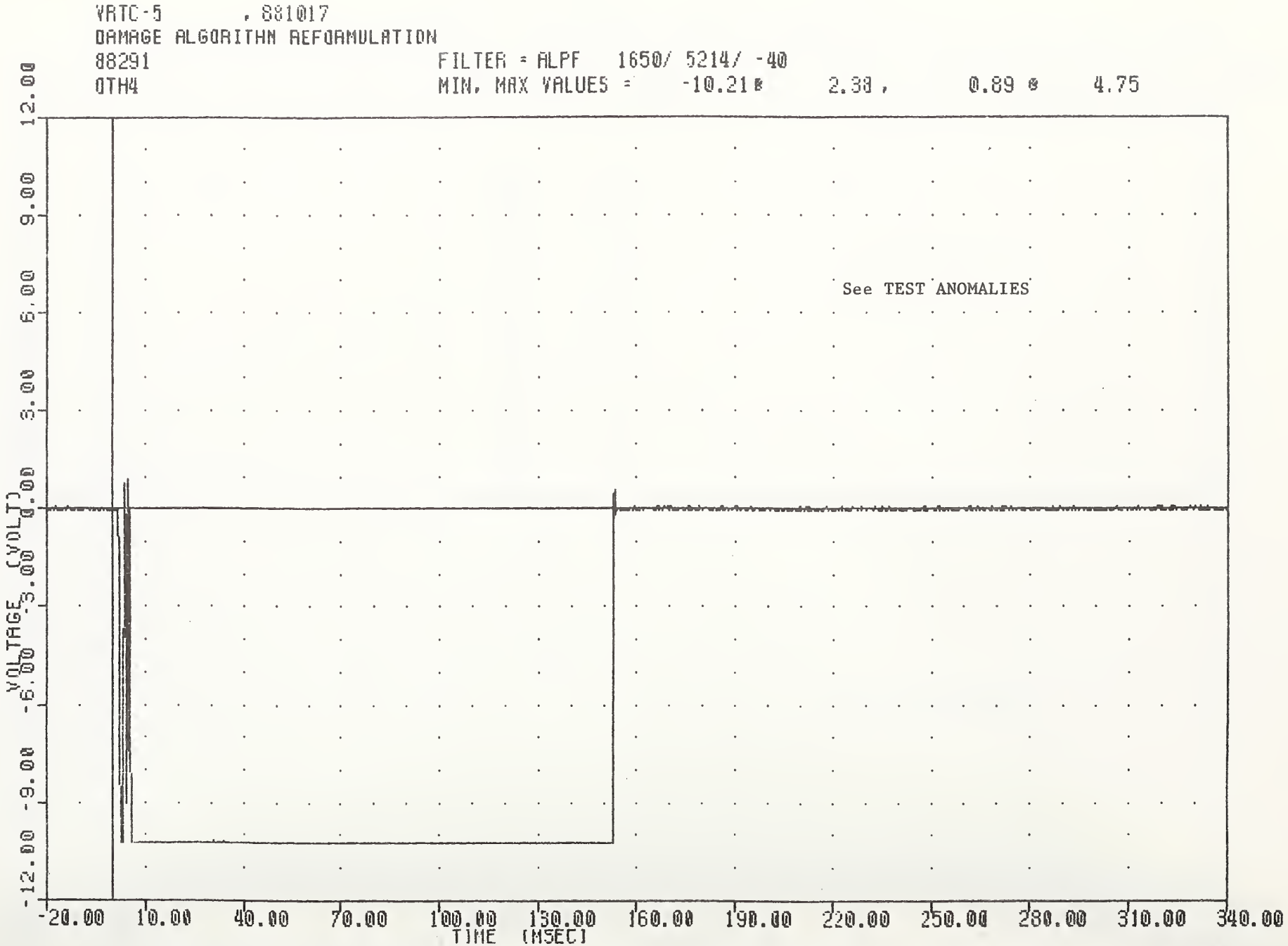
1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 30 MPH FIFTH TEST
VEHICLE CONTACT SWITCH - LEFT



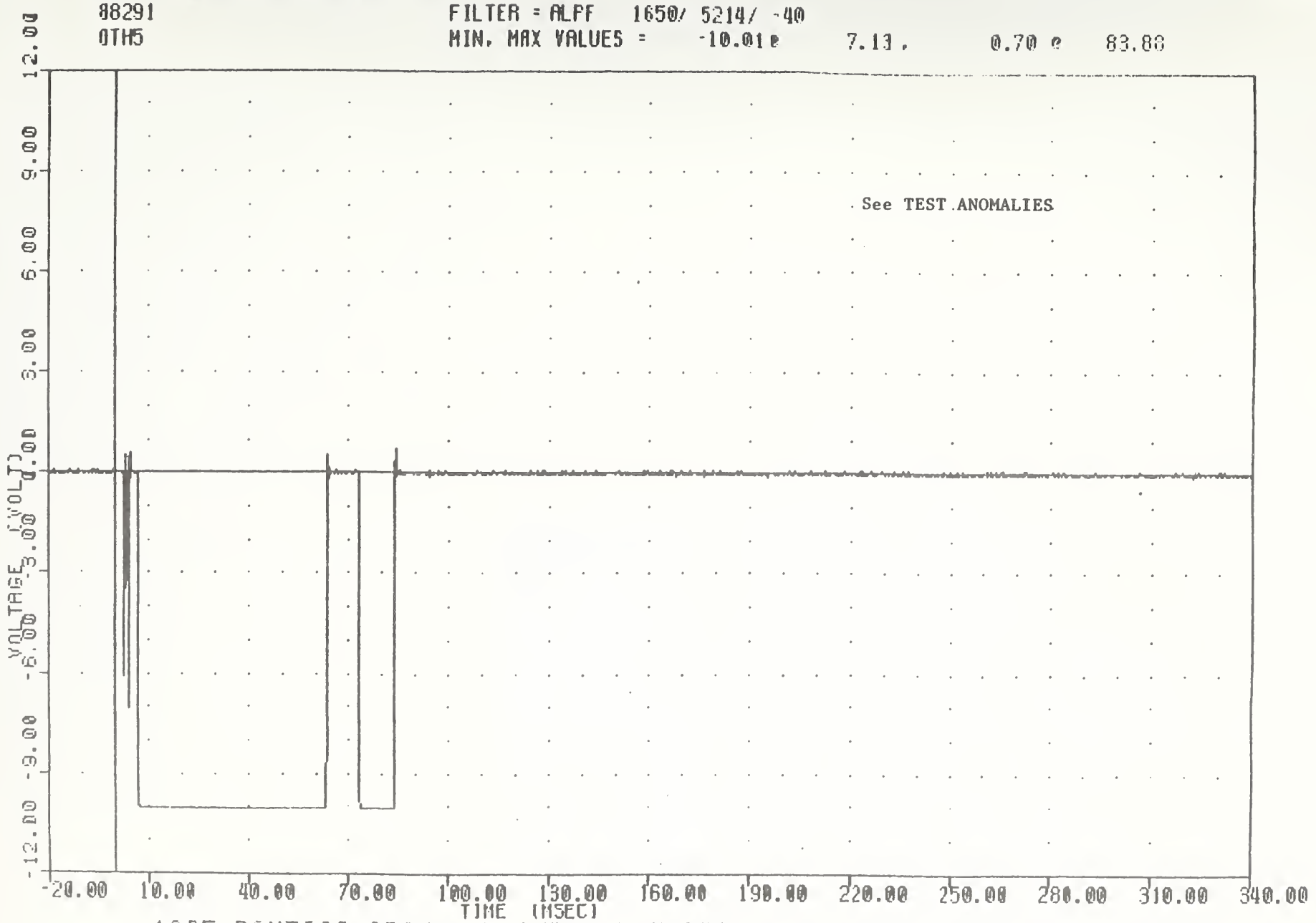
1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 30 MPH FIFTH TEST
VEHICLE CONTACT SWITCH - CENTER



1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 30 MPH FIFTH TEST
VEHICLE CONTACT SWITCH - RIGHT



1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 30 MPH FIFTH TEST
BARRIER CONTACT SWITCH - LEFT



1985 PONTIAC GRAND AM INTO FLAT FRONT BARRIER AT 30 MPH FIFTH TEST
BARRIER CONTACT SWITCH - RIGHT

TL 242 .E4
El-Habash
Final rep
barrier

Form DOT F 1
FORMERLY FORM

DOT LIBRARY
00092141